

MachairWind Offshore Windfarm

Appendix 14.1 Archaeological Assessment of Geophysical and Hydrographic Data



MachairWind Offshore Windfarm



Archaeological Assessment of Geophysical and Hydrographic Data

Produced for Haskoning

MSDS Marine



MSDS
Marine



MSDS
Heritage

MachairWind Offshore Windfarm

Archaeological Assessment of Geophysical and Hydrographic Data

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Author and contact details	MJ [REDACTED]@msdsmarine.co.uk
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Abbreviations

Abbreviation	Description
<	Less than
>	Greater than
AAP	Area of Archaeological Potential
AEZ	Archaeological Exclusion Zone
ALARP	As Low As Reasonably Practical (measure of risk)
.csv	Comma Separated Values
c.	Circa
CES	Crown Estate Scotland
ClfA	Chartered Institute for Archaeologists
Dead (record)	A record that has not been identified during repeat surveys and is believed not exist at the location
DGNSS	Differential Global Navigation Satellite System
ECC	Export Cable Corridor
EIA	Environmental Impact Assessment
ETRS89	European Terrestrial Reference System 1989
FEED	Front End Engineering Design
.gdb	Geodatabase
GIS	Geographical Information System
GW	Gigawatt (unit of measurement)
HES	Historic Environment Scotland
HF	High Frequency
HiPAP	High Precision Acoustic Positioning
Hz	Hertz (unit of measurement)
kg	Kilogram (unit of measurement)
kHz	Kilohertz (unit of measurement)
km	Kilometre (unit of measurement)
LAT	Lowest Astronomical Tide (lowest predicted tide level)
Lifted (record)	A record relating to a shipwreck that is known to have been recovered from the seabed

Abbreviation	Description
LF	Low Frequency
m	Metre (unit of measurement)
MBES	Multibeam Echo Sounder (sonar used for bathymetric modelling of the seabed)
MRU	Motion Reference Unit
MV	Motor Vessel
NLO	Named location (an arbitrary position assigned to shipwreck, or potential shipwreck)
NSTA	North Sea Transition Authority
nT	Nanotesla (unit of measurement)
OAA	Option Agreement Area
OnTDA	Onshore Transmission Development Area
POA	Plan Option Area
PAD	Protocol for Archaeological Discoveries
pUXO	potential Unexploded Ordnance
ROV	Remotely Operated Vehicle
.sgy	SEG file - type Y
.shp	Shapefile
SMP	Sectoral Marine Plan
SBP	Sub-bottom Profiler (sonar used for modelling below the seabed)
SSS	Sidescan Sonar (sonar used for imaging the seabed)
SWR	Steel Wire Rope
.tif	Tagged Image File
TAEZ	Temporary Archaeological Exclusion Zone
UHRS	Ultra-High Resolution Seismic
UK	United Kingdom
UKCS	United Kingdom Continental Shelf
UKHO	United Kingdom Hydrographic Office
USBL	Ultra Short Baseline (acoustic positioning system)
UTM	Universal Transverse Mercator
UXO	Unexploded Ordnance
VORF	Vertical Offshore Reference Frames

Abbreviation	Description
WDA	Windfarm Development Area
WSI	Written Scheme of Investigation
WTG	Wind Turbine Generator
.xtf	eXtended Triton Format

1.0 Introduction

- 1.0.1 MSDS Marine Limited (MSDS Marine) have been contracted by Haskoning to undertake an archaeological assessment of geophysical and hydrographic survey data collected for the MachairWind Offshore Windfarm Development Area (WDA), approximately 15 km northwest of Islay, and 12.4 km west of Colonsay, Scotland.
- 1.0.2 The geophysical and hydrographic surveys were undertaken over two campaigns. A preliminary geophysical and environmental site investigation survey campaign was completed in 2023 by Fugro GB (North) Marine Limited (Fugro). The survey was undertaken within the Option Agreement Area (OAA) to inform the identification of a refined and optimised Windfarm Development Area (WDA). The WDA survey campaign was completed in 2025 by Sulmara Subsea International Limited (Sulmara). Both surveys undertook the collection of Sidescan Sonar (SSS), Multibeam Bathymetry, Magnetometer, Parametric Sub-bottom Profiler (SBP), and Ultra High-Resolution Seismic (UHRS) data (utilising a Sparker as the source system).
- 1.0.3 The archaeological assessment of the data is being undertaken to inform the Environmental Impact Assessment (EIA) process and will be completed in two phases. Phase 1 (this report) forms the assessment of the surface, and near surface datasets to identify anomalies of potential archaeological interest within the WDA. The report outlines the specification of the data, the method of archaeological assessment, the presentation of the results, and recommendations for mitigation strategies
- 1.0.4 Phase 2¹ forms the assessment of the subsurface datasets to inform the palaeolandscape and palaeoenvironmental potential of the WDA.

¹ MSDS Marine, 2026. MachairWind Offshore Windfarm. Archaeological Assessment of Geophysical and Hydrographic Data. Palaeolandscape Assessment. Ref: MCW-DWF-ENV-REP-RHS-000179

2.0 Project location and status

- 2.0.1 In April 2022, as part of the ScotWind leasing round, MachairWind Limited ('the Applicant') entered into an Option to Lease Agreement with Crown Estate Scotland (CES) for the entire W1 Plan Option Area (POA). W1 is one of 15 POAs that the Scottish Government identified in its Sectoral Marine Plan (SMP) for Offshore Wind Energy (Scottish Government, 2020) following comprehensive review and consultation.
- 2.0.2 W1, hereinafter referred to as the OAA, is located off the west coast of Scotland, northwest of Islay and west of Colonsay. To identify the developable area within the OAA, the Applicant undertook a preliminary geophysical and environmental site investigation survey campaign in 2023. Subsequent analysis of this and other datasets enabled the identification of a refined and optimised development area, referred to in the Scoping Report, and this report, as the WDA. Within the WDA a Restricted Build Area has been identified, the WDA Restricted Build Area is not suitable for construction and the installation of Wind Turbine Generators (WTGs). The area outside of the WDA Restricted Build Area is deemed feasible from a technoeconomic perspective taking into account key technical, regulatory, social and environmental constraints.
- 2.0.3 The grid connection location for the Project was confirmed in August 2025 to be in the vicinity of Girvan, South Ayrshire. Consequently, separate consent / marine licence applications will be sought for the Offshore Export Cable Corridor (ECC) and the Onshore Transmission Development Area (OnTDA). When operational, the WDA is anticipated to have a capacity of around 2 Gigawatts (GW) generated by up to 144 WTGs. This will have the potential to generate renewable electricity for up to two million UK homes, contributing to the Scotland and the UK's transition to Net Zero and the UK's energy security in line with Government policy
- 2.0.4 The location of the OAA, WDA, and the WDA Restricted Buildable Area is shown in **Figure 1**.

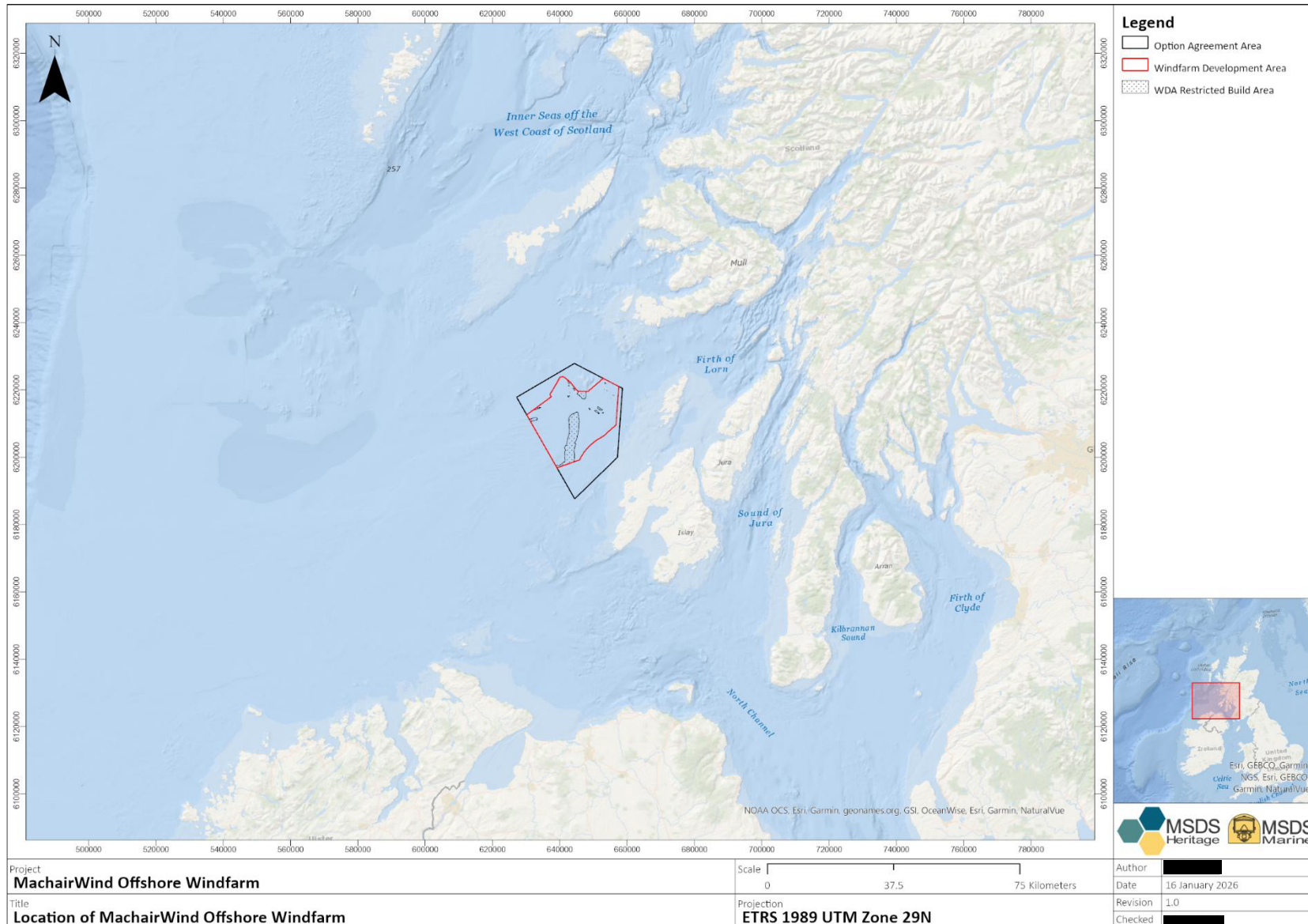


Figure 1: Location of MachairWind Offshore Windfarm

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3.0 Aims and objectives

3.1 Archaeological review of geophysical and hydrographic data

3.1.1 The principal aim of the archaeological review of geophysical and hydrographic data is to establish the presence of material of potential archaeological significance on the seabed. The identification of material allows for strategies to be recommended to mitigate against any negative effects that may be caused by the development process.

3.1.2 The objectives of the archaeological interpretation can be summarised as follows;

- To establish the presence of anthropogenic material of archaeological potential;
- To interpret the identified anomalies as to their potential to be of archaeological significance;
- To recommend mitigation strategies for the anomalies appropriate to their archaeological potential;
- To recommend further works that may be required and their specifications.

4.0 Existing infrastructure

- 4.0.1 Existing third-party infrastructure within the WDA was identified through interrogation of data sets from Kingfisher Information Service – Offshore Renewable & Cable Awareness (KIS-ORCA)² and Oil and Gas data from the United Kingdom Continental Shelf (UKCS) supplied by the North Sea Transition Authority (NSTA)³. In addition, magnetometer data were correlated with the expected positions of infrastructure and used to identify linear features that may represent cables and pipes.
- 4.0.2 No existing, recorded, cables were identified within the WDA or the extents of the geophysical and hydrographic data. No recorded pipelines, wells, bottom holes, or wells paths were identified within the WDA in the extents of the geophysical and hydrographic data.
- 4.0.3 One linear distribution of magnetic anomalies was identified within the WDA. The anomalies span a distance of 13.8 km and are of a size and distribution that may represent an unrecorded cable (or part of). No evidence was visible within the other geophysical or hydrographic datasets.
- 4.0.4 The locations of infrastructure within the wider area are presented in **Figure 2**.

² www.kis-orca.org

³ <https://www.nstauthority.co.uk/data-centre/>

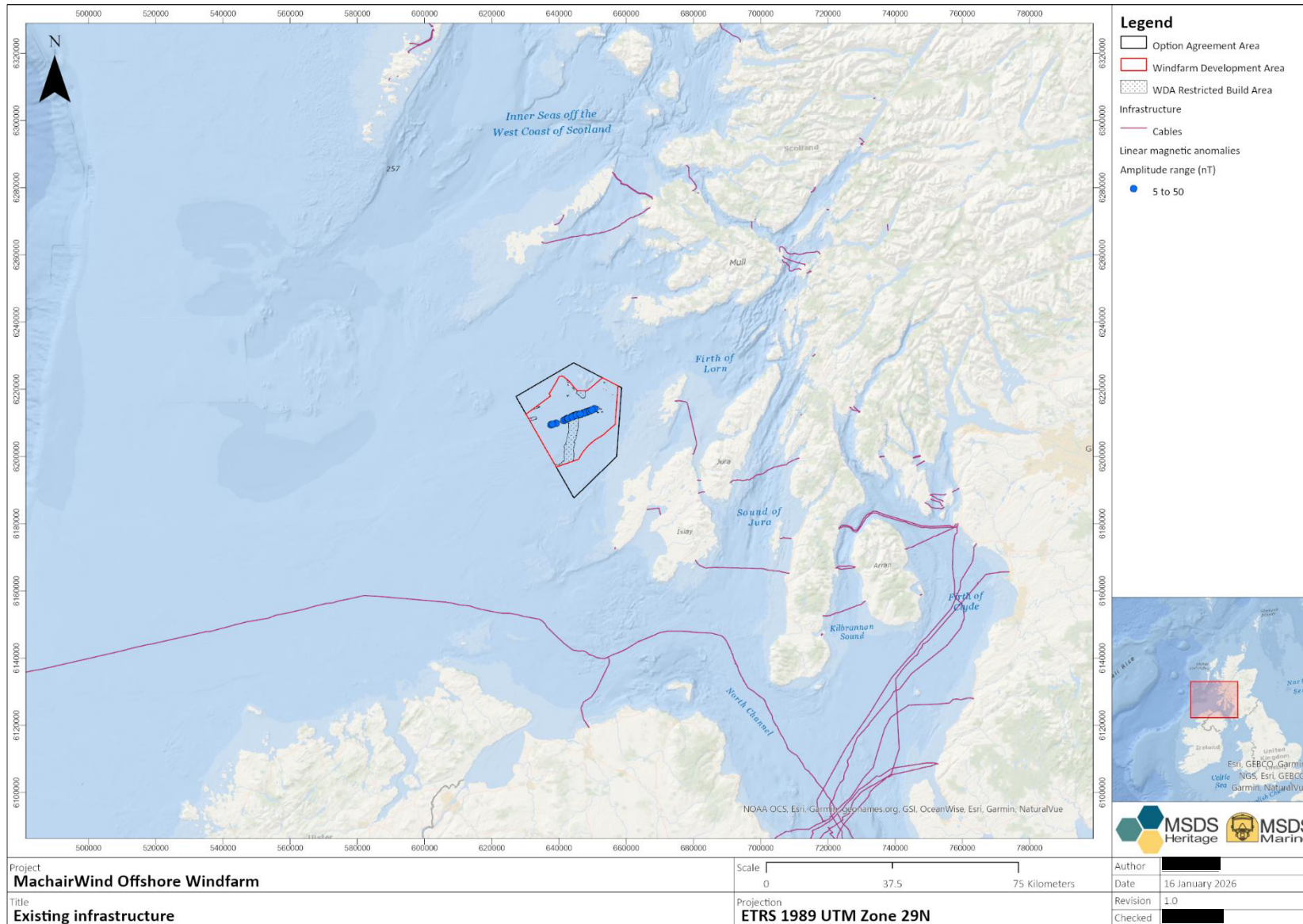


Figure 2: Existing infrastructure

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5.0 Methodology

5.1 Data collection

5.1.1 The geophysical and hydrographic survey was undertaken over two campaigns. A preliminary geophysical and environmental site investigation survey campaign was completed in 2023 by Fugro GB (North) Marine Limited (Fugro). The survey was undertaken within the OAA to inform the identification of a refined and optimised development area (WDA). The WDA survey campaign was completed in 2025 by Sulmara Subsea International Limited (Sulmara). The survey coverage of each campaign is presented in **Figure 3**.

2023 Fugro survey

5.1.2 The Fugro survey was undertaken between 22nd August and 8th November 2023, and consisted of SSS, Multibeam Echo Sounder (MBES), Magnetometer, Parametric SBP, and UHRS. In addition, the survey campaign included the collection of environmental data. All survey operations were undertaken from MV *Fugro Galaxy*, a dedicated survey vessel of 55.6 m.

5.1.3 The SSS, Magnetometer, and UHRS systems were towed behind the vessel, the MBES and SBP were mounted to the vessels.

5.1.4 Survey operations were undertaken within a pre-defined boundary of the OAA of c. 754 km², plus a 1.0 km buffer.

5.1.5 The survey was planned with a line spacing of 500 m for the main lines, and 2,000 m for the cross lines. The line spacing meant that 100% coverage of SSS and MBES data across the OAA was not achieved (nor planned), however the coverage was suitable for the identification of a refined and optimised WDA. In addition, SBP, UHRS, and Magnetometer data were collected along each of the survey lines.

2025 Sulmara survey

5.1.6 The Sulmara survey was undertaken between 14th April and 16th July 2025, and consisted of SSS, MBES, Magnetometer, Parametric SBP, and UHRS. All survey operations were undertaken from *Mainport Edge*, a dedicated survey vessel of 59.6 m.

5.1.7 The SSS, Magnetometer, and UHRS systems were towed behind the vessel, the MBES and SBP were mounted to the vessel.

5.1.8 Survey operations were undertaken within a pre-defined boundary of the WDA of c. 449 km².

5.1.9 The survey was planned with a line spacing of 100 m for the main lines, and 500 m for the cross lines. The line spacing largely ensured >100% coverage of MBES data (with a minimum of 10% overlap) and 200% coverage of SSS (100% at the nadir) across the survey areas

5.1.10 In addition, SBP, UHRS, and Magnetometer data were collected along each of the survey lines.

2023 and 2025 combined survey data

5.1.11 The results of the 2023 and 2025 survey campaigns were combined by Sulmara in 2025, with the resulting datasets being subject to archaeological assessment.

Combined specifications

5.1.12 The equipment specification for the surveys is shown in **Table 1** and **Table 2**. The survey navigation tracklines are presented in **Figure 4**, the SSS coverage in **Figure 5**, and the MBES coverage in **Figure 6**.

Sensor	Manufacturer	Model	Frequency
SSS	Edgetech	4205	230/540 kHz
MBES	Kongsberg	EM2040	400 kHz
Magnetometer	Geometrics	G-882	10 Hz update rate
Parametric SBP	Innomar	Medium-100	6 kHz
UHRS	Applied Acoustics & Geometrics	Dura-Spark UHD-240 & GeoEel LH-16	500 Joules

Table 1: Geophysical and hydrographic sensor specifications (Fugro 2023)

Sensor	Manufacturer	Model	Frequency
SSS	Edgetech	4205	230/540 kHz
MBES	Norbit	Winghead i80s	350 to 450 kHz
Magnetometer	Geometrics	G-882	10 Hz update rate
Parametric SBP	Innomar	SES-2000 Medium-100	6 kHz
UHRS	Applied Acoustics & Geometrics	Dura-Spark UHD-400 & GeoEel LH-16	500 Joules

Table 2: Geophysical and hydrographic sensor specifications (Sulmara 2025)

5.1.13 The data were collected to a specification appropriate to achieve the following interpretation requirements:

- SSS: ensonification of anomalies > 0.6 m;
- MBES: ensonification of anomalies > 1.0 m;
- Magnetometer: 5 nT threshold for anomaly picking;
- Parametric SBP: expected penetration of 10m below seabed was achieved; and
- UHRS: expected penetration of 90m below seabed was achieved.

5.2 Positioning

- 5.2.1 All data were collected with reference to the European Terrestrial Reference System 1989 (ETRS89) datum and Universal Transverse Mercator (UTM) Zone 29 North projection (ETRS89 Z29N). All vertical depths are relative to LAT and were reduced to LAT using Vertical Offshore Reference Frames (VORF).
- 5.2.2 Towed sensors were positioned using an Ultra Short Baseline (USBL) positioning system to ensure positional accuracy throughout the survey. USBL ensures the actual position of the sensor is recorded, as opposed to when the position is estimated based upon the direction of the vessel and the amount of cable out (layback).
- 5.2.3 Although the accuracy of the USBL system is dependent on the angle, and the distance of the beacon from the transceiver, tolerances of between 0.5 m and 2.0 m can be achieved. Positional accuracy is further increased through the correlation of the SSS dataset with the MBES dataset.
- 5.2.4 Surface and subsea position sensors specifications are detailed below in **Table 3** and **Table 4**.

Sensor	Manufacturer	Model	Accuracy
Surface positioning	Kongsberg	Seapath 380 MGC R3 and Seatex MRU5+	Roll / pitch 0.008° Heading 0.01° Position 0.01 m
Subsea positioning	Kongsberg	HiPAP 501	0.12° Angular 0.1 m Range

Table 3: Position sensor specifications (Fugro 2023)

Sensor	Manufacturer	Model	Accuracy
Surface positioning	Applanix	POS MV	Roll / pitch 0.008° Heading 0.02° Position 0.01 m
Subsea positioning	Kongsberg	HiPAP 501	0.12° Angular 0.1 m Range

Table 4: Position sensor specifications (Sulmara 2025)

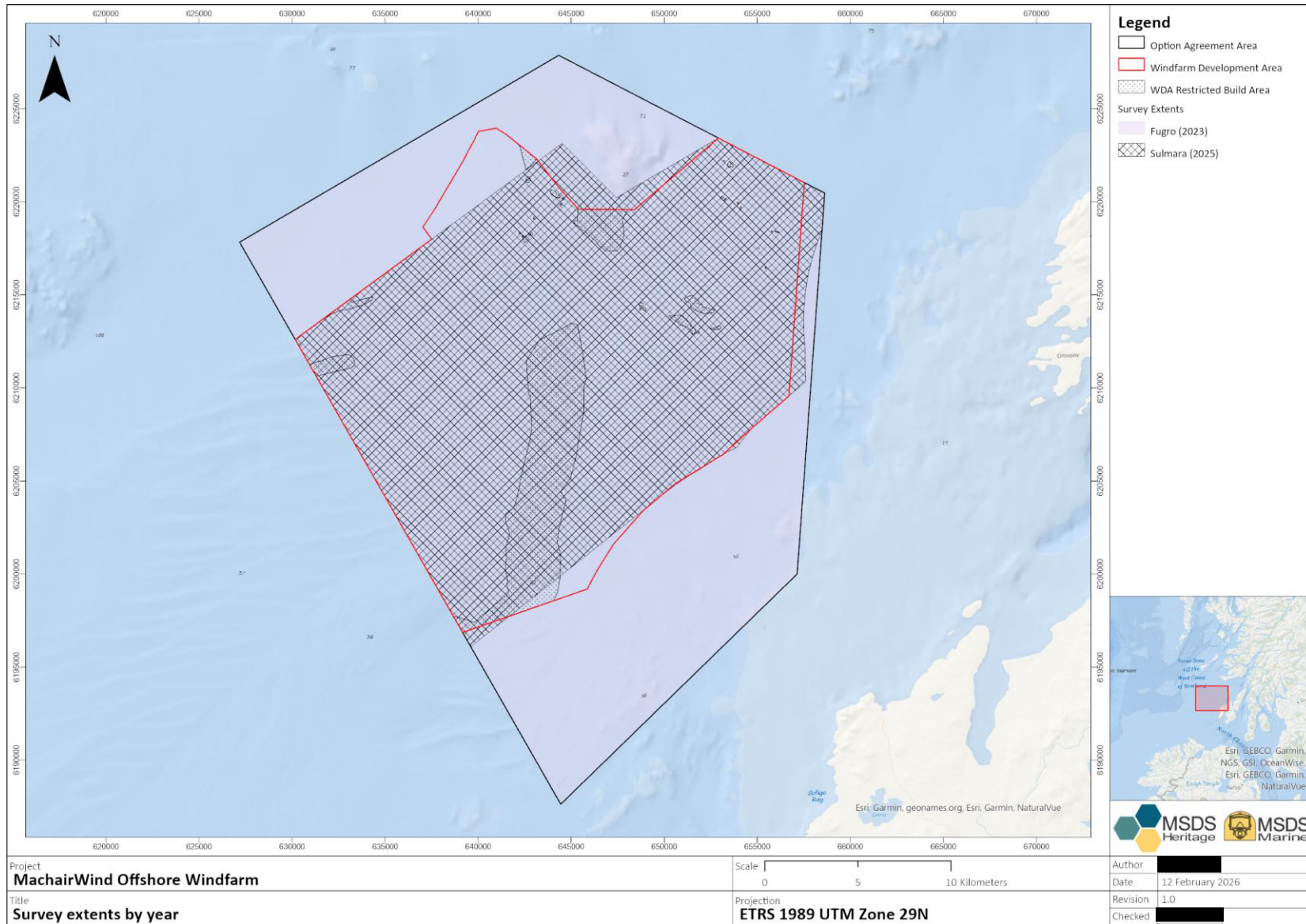


Figure 3: Survey extents by year

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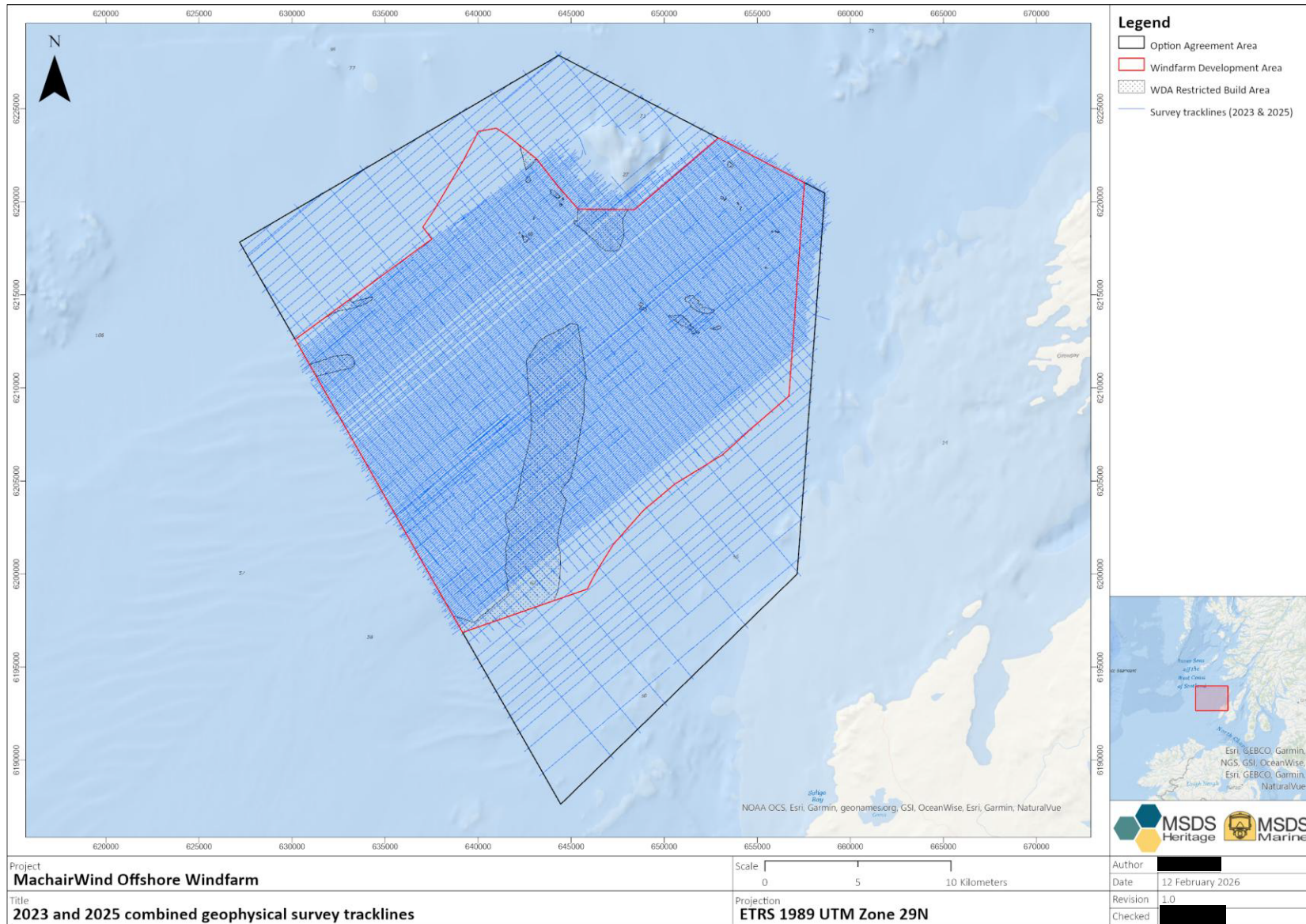


Figure 4: 2023 and 2025 combined geophysical survey tracklines

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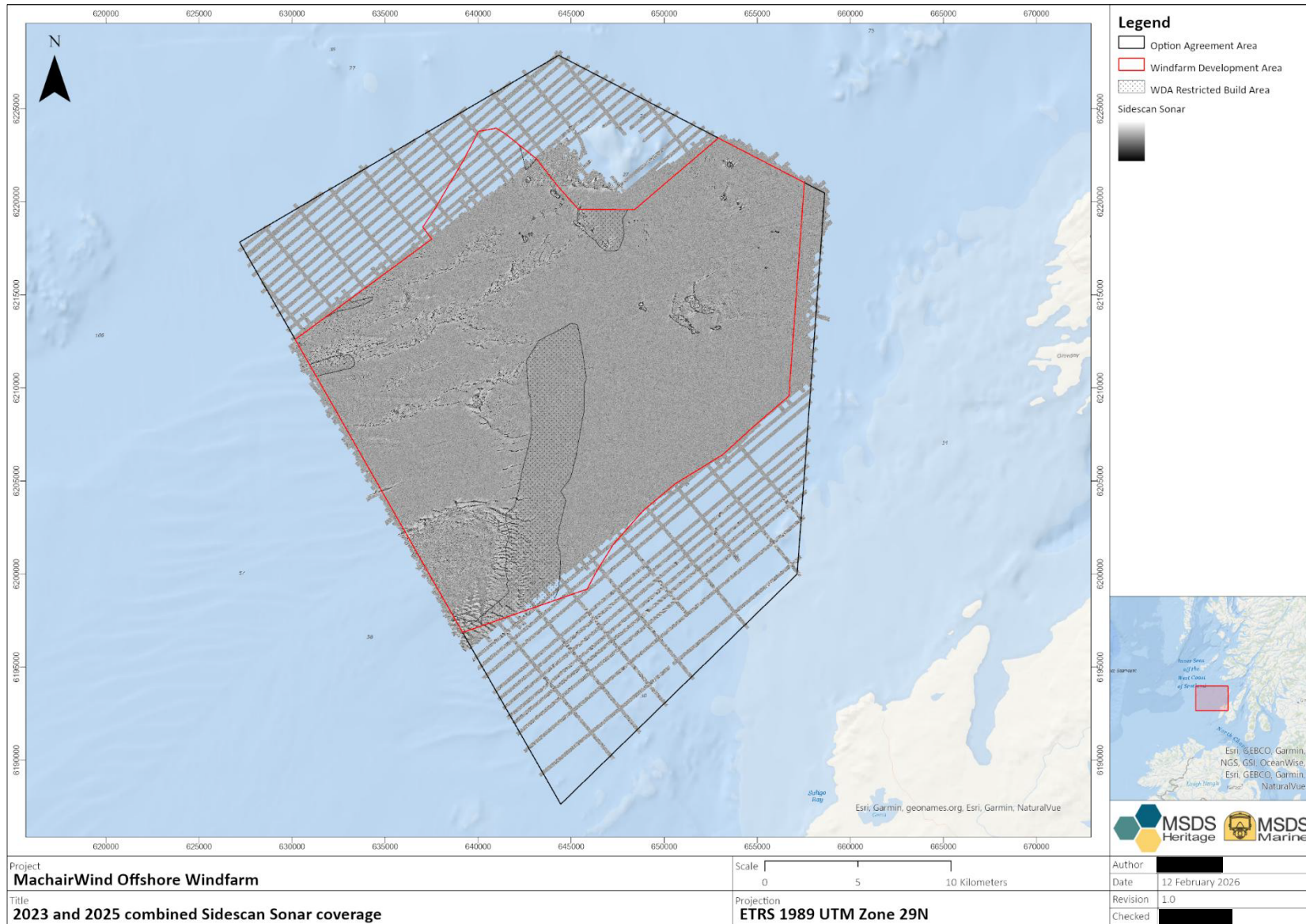


Figure 5: 2023 and 2025 combined SSS coverage

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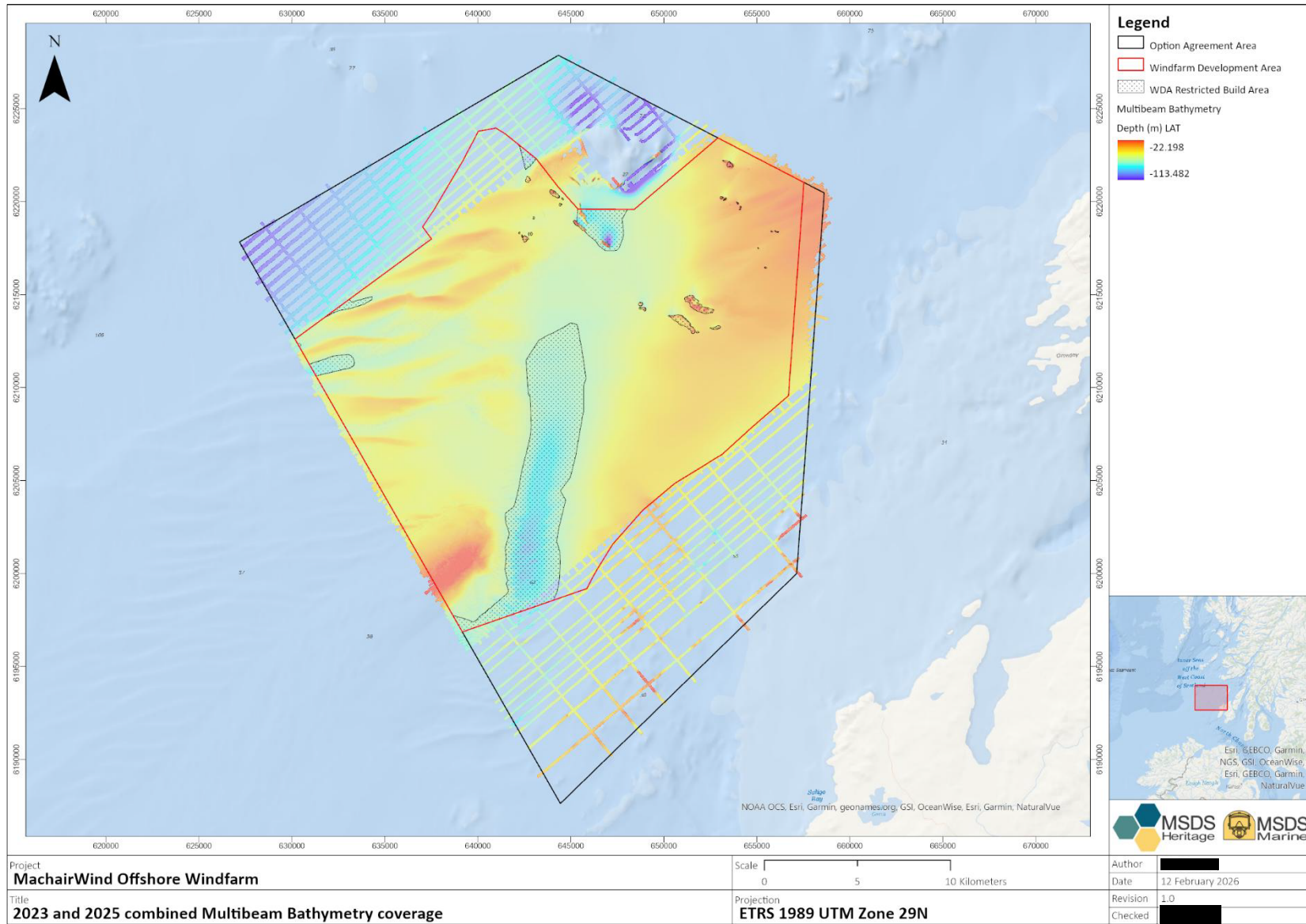


Figure 6: 2023 and 2025 combined Multibeam Bathymetry coverage

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5.3 Data deliverables to MSDS Marine

5.3.1 MSDS Marine were provided with the survey deliverables for the Fugro (2023) and Sulmara (2025) surveys by Haskoning. The data included both raw and processed data, alongside interpretations and operations reports. The primary deliverables are detailed in **Table 5** below.

Sensor	Data type	Format
SSS	Raw lines (LF and HF)	.xtf
	Processed lines (HF)	.xtf
	Mosaic (HF) 0.25 ppm	.tif
	Contacts	.shp
SBP	Raw lines	.sgy
	Processed lines	.sgy
	Isopach	.shp
	Horizons	.tif
Magnetometer	Raw lines	.csv
	Grids	.tif
	Contacts	.csv
MBES	Raw lines	.xyz
	Grids (at 0.5 m)	.xyz
	Mosaic (at 0.5 m)	.tiff
GIS	Geodatabase	.gdb
Reports	Interpretation report	.pdf
	Operations report	.pdf
	Mobilisation report	.pdf

Table 5: Data deliverables to MSDS Marine

5.4 Data quality and limitations

General notes on data quality and limitations

- 5.4.1 The data has been collected in two phases, by Fugro in 2023 covering the OAA at a wide survey line spacing, and by Sulmara in 2025 covering the WDA at a narrower line spacing. The below discussion focuses on the data within the WDA as this is the area being taken forward for consent.
- 5.4.2 Due to changes in the WDA boundary, first following scoping and then following the 2025 survey, there are areas within the current WDA that are only covered by the 2023 survey. These gaps are to the southeast and the north of the WDA and total c. 20 km², of which c. 2km² is the WDA Restricted Build Area (**Figure 7**). Within these areas only the 2023 data have been subject to archaeological assessment, thus 100% of the seabed has not been assessed. As a percentage of the total WDA this area is relatively small (c.4.5%), and thus the overall coverage of the WDA is considered of appropriate coverage to undertake a robust archaeological assessment to inform the EIA process, noting that additional data collection, and interpretation, will be required prior to construction.

Sidescan Sonar (SSS)

- 5.4.3 The SSS data covered the extents of the WDA (noting the c. 20 km² gap in 2025 data), providing coverage of approximately 200% (100% coverage at the nadir). The data were generally of average to good quality, with some minor interference or data degradation caused by environmental factors, or the simultaneous use of different sensors. In areas, the presence of fish and floating debris (potentially) obscured some areas of the seabed, however the coverage of 200% SSS data, and >100% MBES data largely mitigated this.
- 5.4.4 Some small horizontal offsets were noted in places between the SSS and MBES data, although these were not significant and were within what would be considered normal tolerances. However, the positions of medium and high potential (and a large number of low potential) anomalies were taken from the MBES data to ensure positional accuracy.
- 5.4.5 Seabed composition varies across the WDA predominantly comprising sand with shell fragments. Areas of coarser material, ranging from gravelly sands, cobbles and boulders are noted to the south, southwest and the north of the WDA (**Figure 8**). Seabed features are characterised by sand banks and ripples to the northwest, megaripples and ripples to the south, and rock outcrop to the north and northeast (**Figure 9**).
- 5.4.6 Prominent features, such ripples and sand banks, and rock outcrops can cause obstructions to the line of sight of sonar data, in particular the SSS, the data from which is collected closer to the seabed. Typically, this is mitigated through the collection of 200% coverage SSS data, ensuring that the seabed is ensonified from two directions, and the simultaneous assessment of MBES data which is collected from above.

Multibeam Bathymetry (MBES)

- 5.4.7 The MBES data covered the extents of the WDA (noting the c. 20 km² gap in 2025 data), providing coverage of >100%. A review of the un-gridded point cloud data shows that the quality is good with no significant height or positioning errors that effect the overall dataset. The data density is good, and the data is able to be gridded to 0.5 m, increasing the ability to identify smaller features. Features identified within the MBES data generally correlate well with

those identified in the SSS data.

- 5.4.8 MBES data is considered to provide the most accurate positioning due to the direct, and fixed, correlation between the sensor, the DGNS antennas, and the Motion Reference Unit (MRU) and is the primary source of anomaly positioning.

Magnetometer

- 5.4.9 The Magnetometer data covered the extents of the WDA (noting the c. 20 km² gap in 2025 data) and was collected along the pre-defined survey line plan of 100 m in most areas. The data were sampled at 10 Hz, and the data were suitable to identify anomalies with a peak-to-peak amplitude of 5 nT. It should be noted that the 100 m line spacing achieved within the WDA is too great for the accurate positioning of magnetic anomalies at distances away from the tracklines but can indicate areas of archaeological potential or can be correlated with visible feature on the seabed that lie on the same plane. Due to the line spacing it is likely that buried ferrous material, particularly smaller objects, between the run lines will not have been identified within the data. This approach to data collection is usual at EIA stage with the development footprint being refined post consent, and additional surveys with tighter line spacing being undertaken prior to construction.

Sub-bottom profiler (SBP)

- 5.4.10 The SBP and UHRS data covered the extents of the pre-defined survey boundary. The assessment of data quality and limitations will be included within the forthcoming palaeolandscape assessment⁴.
- 5.4.11 SBP and UHRS data is collected directly beneath the sensor, in general terms, and outside the identification of the palaeolandscape, SBP is not suited to the prospection for buried material of potential anthropogenic origin due to the wide line spacing. It can however be useful for the corroboration of other datasets where a trackline passes directly over a magnetic anomaly, or a potentially buried feature, visible in the SSS or MBES data.

Summary

- 5.4.12 The data collected across the extents of the WDA are generally of average to good quality overall, with the MBES providing >100% coverage and the SSS providing 200% coverage (100% at the nadir) (noting the c. 20 km² gap in 2025 data). The Magnetometer data were collected to a pre-determined line plan suitable for the identification of ferrous material with a peak to peak amplitude of 5 nT, with the minimum detection size increasing with distance from the tracklines.
- 5.4.13 The data is considered of an appropriate specification, coverage, and quality, to undertake a robust archaeological assessment to inform the EIA process, noting that additional data collection, and interpretation, will be required prior to construction.

⁴ MSDS Marine, 2026. MachairWind Offshore Windfarm. Archaeological Assessment of Geophysical and Hydrographic Data. Palaeolandscape Assessment. Ref: MCW-DWF-ENV-REP-RHS-000179

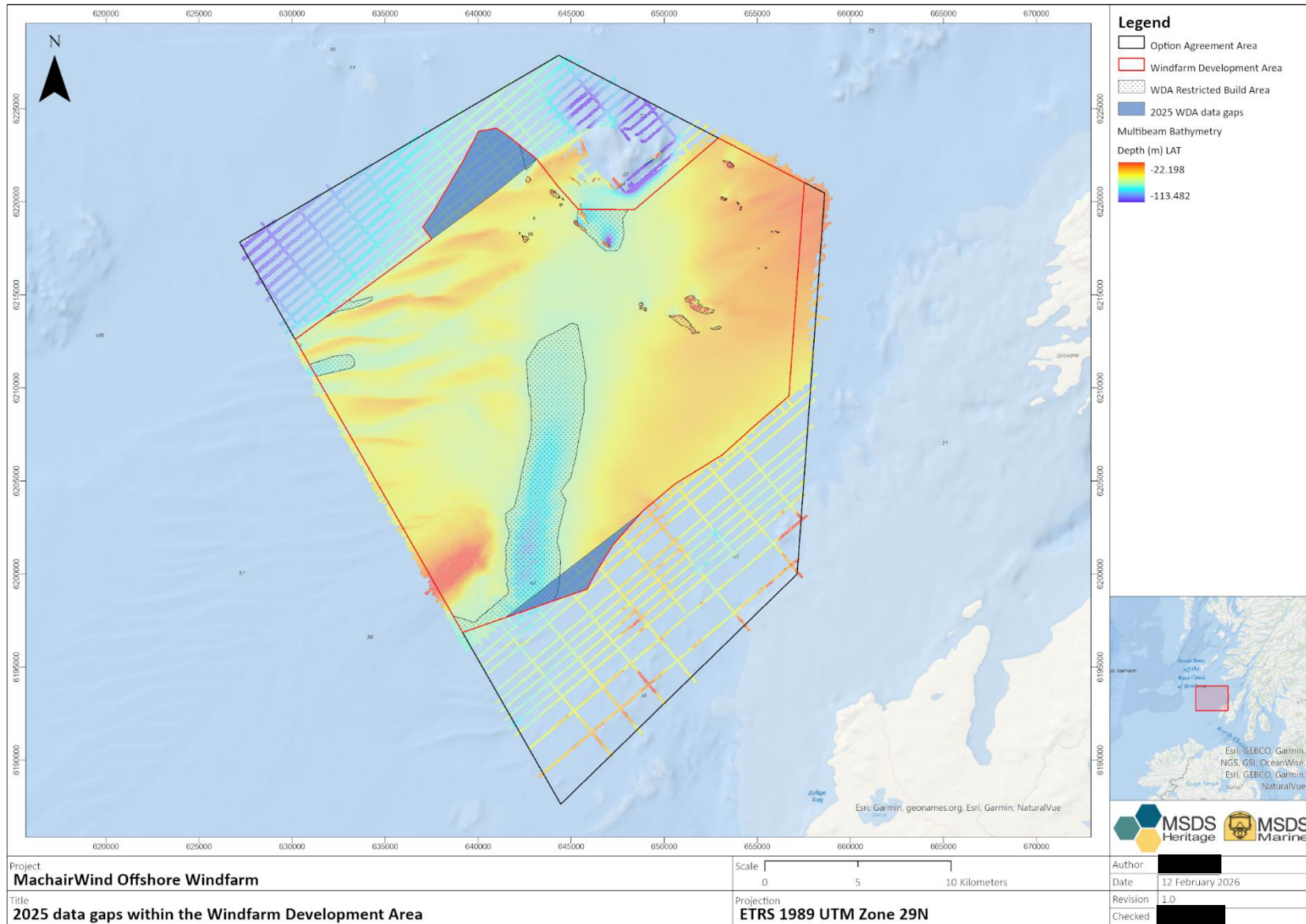


Figure 7: 2025 data gaps within the Windfarm Development Area

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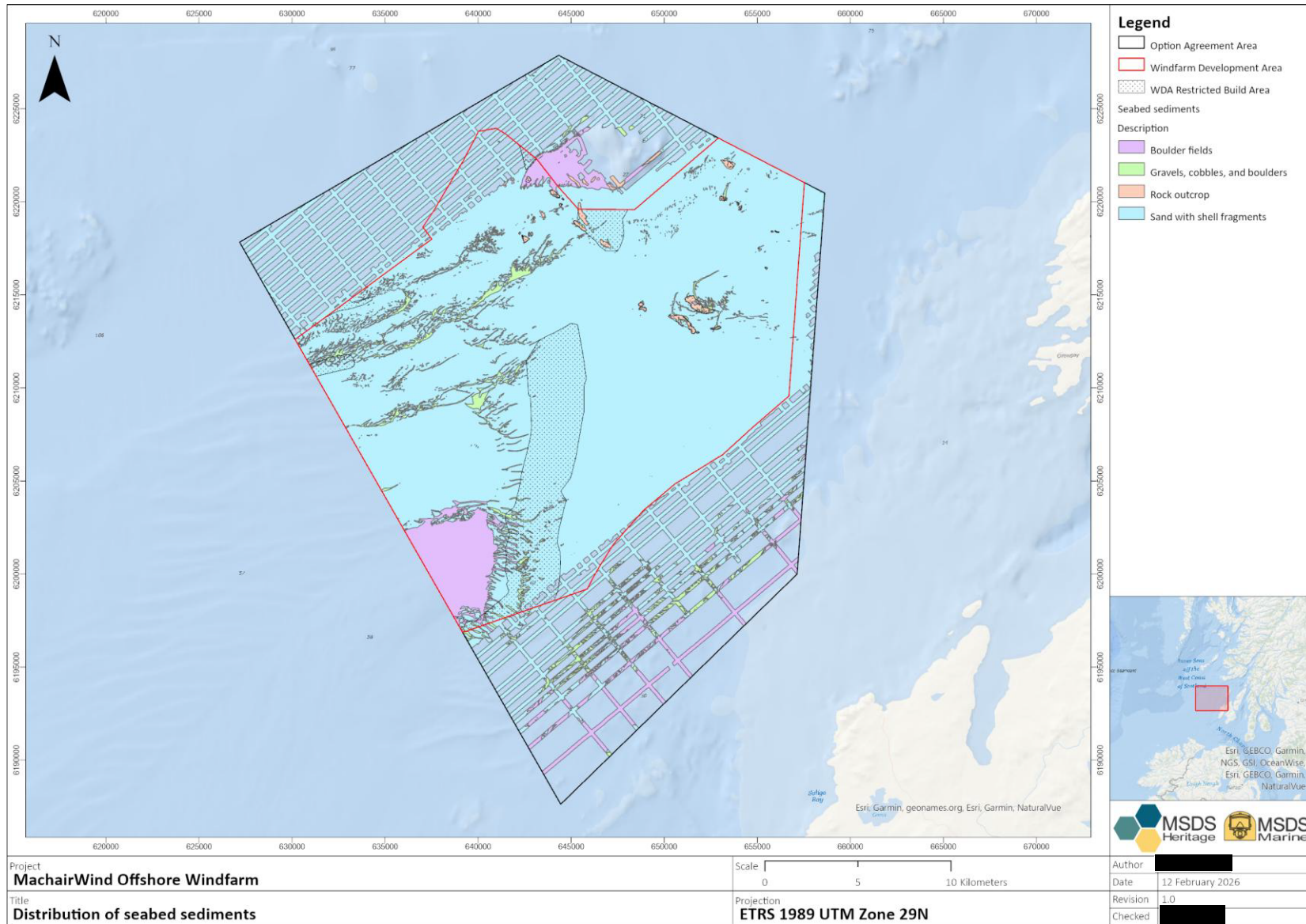


Figure 8: Distribution of Seabed Sediments

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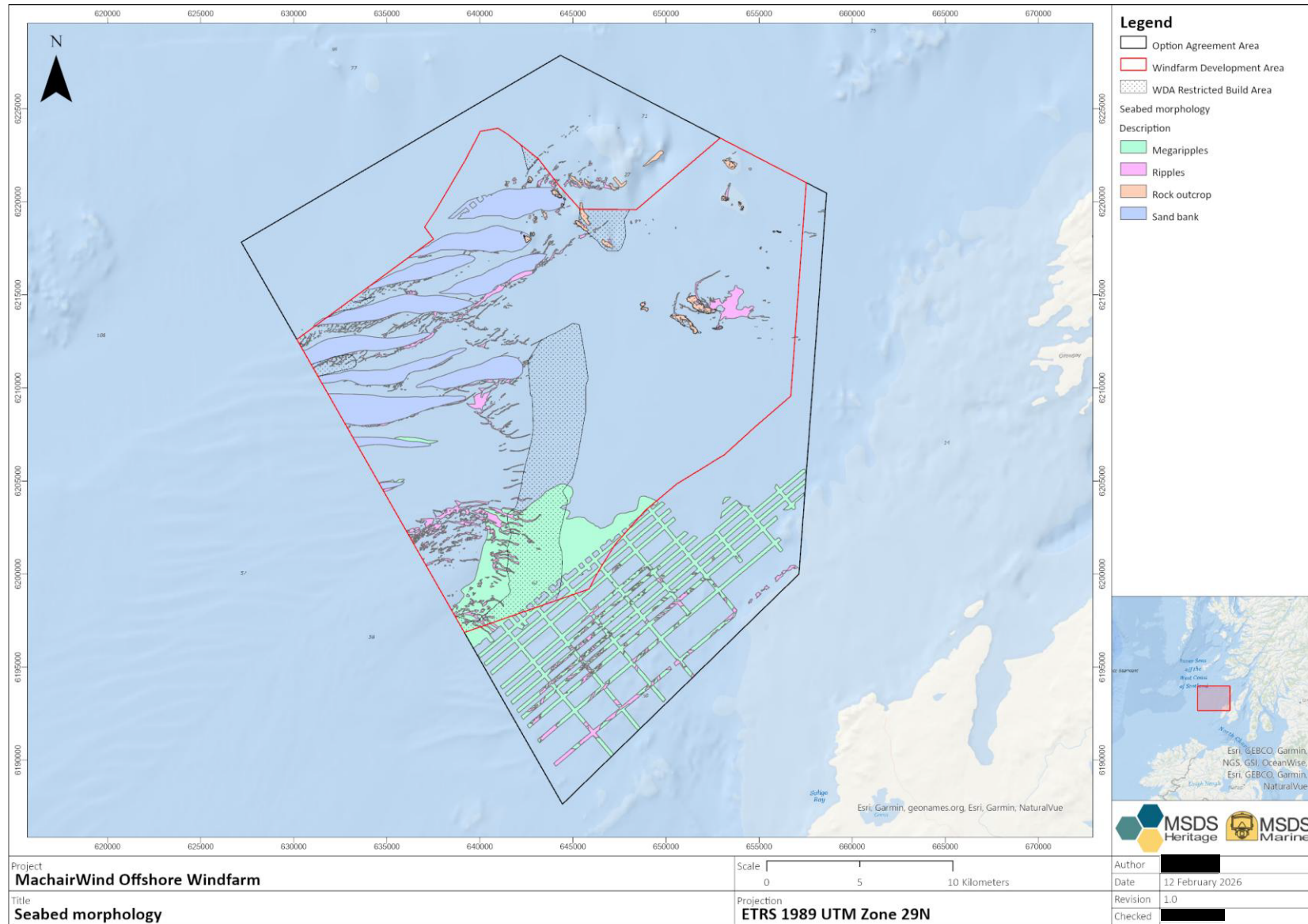


Figure 9: Seabed morphology

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5.5 Archaeological assessment of data

- 5.5.1 The archaeological assessment of data was undertaken by a qualified and experienced maritime archaeologist with a background in geophysical and hydrographic data acquisition, processing, and interpretation.
- 5.5.2 Following delivery of the required datasets, an initial review was undertaken to gain an understanding of the geological and topographic make-up of the survey area. Within the extent of the survey area the potential for variations in the seabed are high and can affect the interpretation of anomalies. The assessment considers the full extents of the survey data, which was collected within a pre-defined survey boundary, including the WDA. The assessment of United Kingdom Hydrographic Office (UKHO)⁵ and Canmore data⁶ was undertaken within the extents of the OAA, relating to seabed wrecks and obstructions (UKHO) and historic environment assets, wrecks and documented sightings/experiences of historic wrecks (Canmore). These data are used to inform of known wrecks or the likelihood of encountering physical remains relating to such.
- 5.5.3 Whilst some of the data extends beyond the WDA, the purpose of the assessment is to characterise the historic environment and therefore data from the wider area were considered. The focus of the mitigation measures is, however, on anomalies within the WDA, or where mitigation measures would be effective within the WDA. The WDA is presented in **Figure 1**.

Sidescan Sonar (SSS)

- 5.5.4 SSS is considered the best tool for the identification of anthropogenic anomalies on the seabed due to the ability to ensonify small features and as such forms the basis of any archaeological assessment of data. SSS data in .xtf format were imported into Moga Seaview 6.5 software, navigation and positioning were checked and corrected where required, and optimal gains were applied to ensure the consistent presentation of data.
- 5.5.5 Data were reviewed on a line-by-line basis, and all anomalies of potential anthropogenic origin identified and recorded. Records include at a minimum an image of the anomaly, dimensions, and a description. Whilst typically only images of medium and high potential anomalies are presented with the assessment report, images of all anomalies are recorded as interpretations can change as the data assessment progresses. A rating of archaeological potential was assigned to the anomaly following the criteria outlined in **Table 6** below.
- 5.5.6 Following assessment of the individual lines, a mosaic was created and a Geotiff exported to allow for the checking of positional accuracy against the MBES data and to identify the extents of any anomalies that may have extended past the limits of individual lines.

Magnetometer

- 5.5.7 Magnetometer data indicates the presence of ferrous, and thus usually anthropogenic, material both on, and under the seabed. Where line spacing allows, typically to a specification for the detection of potential UXO, magnetometer data can provide accurate positions of buried ferrous anomalies. The survey line spacing is c.100 m which is too great for the accurate positioning of magnetic anomalies at distances away from the tracklines but can indicate areas

⁵ <https://datahub.admiralty.co.uk/portal/apps/sites/#/marine-data-portal/datasets/4dbf2ace22bf4f9785fb445d0593bc2c/about> Accessed 20/10/2025.

⁶ <https://portal.historicenvironment.scot/apex/f?p=PORTAL:downloads:::DATASET:NHRE> Accessed 20/10/2025.

of archaeological potential. Where possible, magnetic anomalies were correlated with anomalies visible on the seabed.

- 5.5.8 Magnetometry data were provided as .csv files and as a gazetteer detailing all anomalies greater than 5 nT. An assessment was made by MSDS Marine as to the suitability of the gazetteer for archaeological interpretation. Where required the .csv magnetometer data were imported into Moga Seaview 6.5 software where the data were smoothed, and a 'baseline' identified and removed from the data to highlight ferrous anomalies whilst taking into account geological variations in the data.
- 5.5.9 Magnetic anomalies without a correlating surface anomaly had the position, amplitude, and dimensions recorded. Where the position of a magnetic anomaly can be determined a rating of archaeological potential was assigned to the anomaly following the criteria outlined in **Table 6** below. For all other anomalies a statement of potential was provided taking into consideration the survey specifications and the underlying geology. The data were gridded to visually identify areas where the distribution of anomalies may represent a wider feature such a buried but dispersed wreck, or modern features such as buried cable or chain.

Multibeam Bathymetry (MBES)

- 5.5.10 Due to the minimum anomaly detection size of MBES data being larger than that of SSS data, the primary use during archaeological assessment, outside of seabed characterisation, is the corroboration of anomalies identified within other datasets and the visualisation of anomalies that may otherwise be obscured by shadow.
- 5.5.11 Navigation corrected, but unprocessed, MBES data were provide to MSDS Marine as .xyz files, the data were imported into QPS Fledermaus where it was gridded and exported as a depth embedded raster, the raster was imported into ArcGIS Pro 3.5 and a hill-shaded surface applied, shading was adjusted to ensure the optimal presentation of data. The resulting 3-Dimensional image was viewed on a block-by-block basis, and all anomalies of potential anthropogenic origin identified and recorded.
- 5.5.12 Records include, at a minimum, an image of the anomaly, dimensions, and a description. A rating of archaeological potential was assigned to the anomaly following the criteria outlined in **Table 6** below. Where the interpretation of an anomaly was unclear, the data were imported into point cloud visualisation software such as Cloud Compare to view the un-gridded data. The gridded surface image was exported as a Geotiff to allow further assessment alongside other datasets.

Potential	Criteria
Low	An anomaly potentially of anthropogenic origin but that is unlikely to be of archaeological significance – Examples may include discarded modern debris such as rope, cable, chain, or fishing gear; small, isolated anomalies with no wider context; or small boulder-like features with associated magnetometer readings.
Medium	An anomaly believed to be of anthropogenic origin but that would require further investigation to establish its archaeological significance – Examples may include larger unidentifiable debris or clusters of debris, unidentifiable structures, or significant magnetic anomalies.
High	An anomaly almost certainly of anthropogenic origin and with a high potential of being of archaeological significance – high potential anomalies tend to be the remains of wrecks, the suspected remains of wrecks, or known structures of archaeological significance.

Table 6: Criteria for the assessment of archaeological potential

Combined assessment

- 5.5.13 Following the assessment of all datasets the results were loaded into ESRI ArcGIS Pro 3.5, a Geographical Information System (GIS), and reviewed alongside each other, along with Geotiffs of the SSS, MBES, and Magnetometer data. The concurrent review allows the amalgamation of duplicate anomalies, the assessment of the wider context, and an understanding of the extents of a feature that may be partially buried or span across two or more lines of data.
- 5.5.14 Data from the UKHO, including the positions of wrecks and obstructions, and Canmore, as well as all other relevant data such as third-party assets (see **Section 4.0**) were assessed to ensure that any additional information is drawn upon, but also that anomalies are not unnecessarily identified as having archaeological potential when the origination can be identified. The resultant remaining anomalies assessed as having archaeological potential were compiled into a gazetteer and a shapefile.
- 5.5.15 The interpretation of geophysical and hydrographic data is, by its very nature, subjective. However, with experience and by analysing the form, size, and characteristics of an anomaly, a reasonable degree of certainty as to the origin of an anomaly can be achieved.
- 5.5.16 Measurements can be taken in most data processing software, and whilst largely accurate, discrepancies can be noted due to a number of factors. Where there is uncertainty as to the potential of an anomaly, or its origin, a precautionary approach is always taken to ensure the most appropriate mitigation for the historic environment.
- 5.5.17 It should be noted that there may be instances where an anomaly may exist on the seabed but not be visible in the geophysical data. This may be due to being covered by sediment or being obscured from the line of sight of the sonar. The use of both SSS and MBES data mitigates this by visualising anomalies from multiples angles, including from above. Anomalies were named following the standard MSDS Marine convention, [PROJECTYEAR_ID], e.g., MCH25_XXX.

5.6 Mitigation (methodology)

5.6.1 The following section discusses the archaeological mitigation strategies which are considered for the WDA, the proposed mitigation is presented in **Section 10.0**.

Surface anomalies

5.6.2 To ensure the most appropriate and robust mitigation for the historic environment, whilst being proportional to the requirements of the development, mitigation recommendations are determined on an anomaly-by-anomaly basis, and consider all available data including;

- Potential significance;
- Size;
- Seabed type;
- Seabed dynamics;
- Development type; and
- Potential negative impacts.

5.6.3 Mitigation strategies have been based on the criteria in **Table 7** below.

Potential	Criteria
Low	No archaeological significance interpreted, and a low potential to be of archaeological significance. Maintain an operational awareness of the anomaly's location and reporting through an agreed protocol for archaeological discoveries, should material of potential archaeological significance be encountered.
Medium	Avoidance of the anomaly's position and where appropriate an archaeological exclusion zone may be recommended. Ground truthing of the anomaly through the use of divers or an Remotely Operated Vehicle (ROV) would establish the archaeological potential.
High	Archaeological exclusion zones will be recommended based on the size of the anomaly, any outlying debris and the seabed dynamics as interpreted from the SSS and MBES data.

Table 7: Mitigation criteria for archaeological anomalies

5.6.4 Where an anomaly is visible in the MBES data, that position will generally be used for the implementation of mitigation recommendations. The position obtained from the MBES data is generally more accurate due to the sensor and the GNSS receiver being fixed to the vessel in known planes. SSS and magnetometer sensors are towed, and thus the margin for error is greater even with USBL, as the positional tolerance can be between 0.5 m and 2.0 m.

5.6.5 A phased approach to mitigation is proposed for the WDA, corresponding with the planned future survey strategy. The survey specification was designed for the purposes of consenting

and Front End Engineering Design (FEED) to determine the most appropriate area for development. Future surveys will likely combine an increase in resolution, and the addition of magnetometer data with tighter line spacing (as determined by the potential Unexploded Ordnance (pUXO) risk), within the WDA. With the data resolution and coverage set to increase, the confidence in interpretation and appropriateness of mitigation strategies will also increase. Following the archaeological assessment, recommendations have been made as to the coverage and specification of future surveys to ensure a robust archaeological assessment of the development area at all stages of the development process.

- 5.6.6 At this phase, differentiation has made between anomalies that are visible and identifiable in the survey data (e.g., SSS and MBES anomalies), and potential anomalies that have not been identified in the survey data but are likely to exist on the seabed (e.g., Live UKHO records).
- 5.6.7 The mitigation strategies detailed in **Table 8** have been used.

Potential	Criteria
Archaeological Exclusion Zones (AEZs)	For archaeologically significant anomalies that are clearly identifiable in the survey data and where the extents are largely known, Archaeological Exclusion Zones (AEZs) will be recommended. AEZs will remain for the life of The Project or until ground truthing or higher resolution data determines a reduction in potential, significance, or extents.
Temporary Archaeological Exclusion Zones (TAEZs)	Where an anomaly is not visible in the survey data but likely to exist on the seabed at a known position or where the extents of an anomaly are not fully identifiable, Temporary Archaeological Exclusion Zones (TAEZs) will be recommended. TAEZs have been identified as highly likely to be altered following higher resolution or full coverage data assessment, however, they will remain in place until alterations have been formally agreed with MD-LOT following consultation with Historic Environment Scotland (HES).
Areas of Archaeological Potential (AAP)	Areas of Archaeological Potential (AAP) are primarily reserved for magnetic anomalies where, due to line spacing, positions are not accurately known. AAPs demonstrate that there is potentially an anomaly of archaeological significance around the given position. The anomaly is likely to be identified following higher resolution or full coverage data assessment but as the nature and position is not precisely known, no formal exclusion zone is recommended but instead a general awareness of the position is considered appropriate at this phase.

Table 8: Archaeological mitigation strategies

6.0 Results of surface geophysical anomalies

- 6.0.1 For the avoidance of confusion, the results of magnetic anomalies with no surface expression are presented in **Section 7.0**, UKHO records in Section 8.0, and Canmore records in **Section 9.0**.
- 6.0.2 A total of 65 surface anomalies of potential archaeological interest were identified within the geophysical survey data extents, of which 49 are within the WDA. The anomalies are categorised by potential in **Table 9**.

Potential	WDA	OAA	Total
Low	44	11	55
Medium	4	4	8
High	1	1	2
Total	49	16	65

Table 9: Distribution of archaeological anomalies by potential

- 6.0.3 The distribution of anomalies is shown in **Figure 10**, as can be noted the distribution is fairly uniform across the surveyed area. The ratios, and distribution, of high, medium, and low potential anomalies are relatively consistent with a typical archaeological assessment of data.
- 6.0.4 The distribution of anomalies within the geophysical data shows a consistent approach to the assessment. The high, medium, and low potential anomalies are discussed below according to their assessed potential.

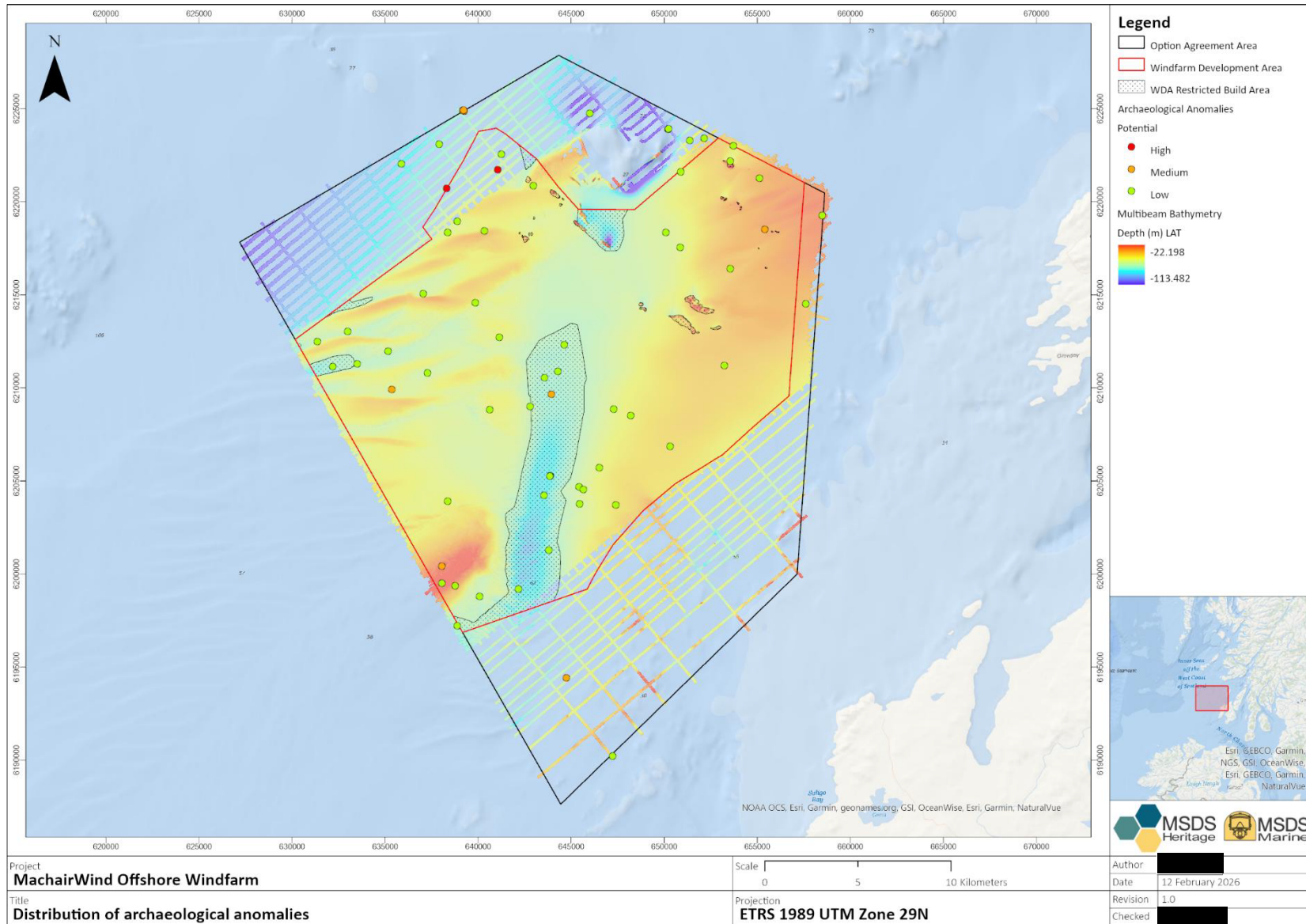


Figure 10: Distribution of Archaeological Anomalies

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6.1 Low potential anomalies

6.1.1 55 anomalies interpreted as of low archaeological potential were identified within the geophysical survey data extents, of which 44 are within the WDA. The anomalies can be categorised as follows in **Table 10**.

Anomaly category	WDA	OAA	Total
Chain, cable, or rope	0	1	1
Likely geological	8	1	9
Potential debris	19	7	26
Fishing gear	13	1	14
Seabed disturbance	4	1	5
Total	44	11	55

Table 10: Low potential anomaly categories

- 6.1.2 The anomalies interpreted as of low archaeological potential (see **Table 6** for definitions) are a mixture of small features, often boulder-like, or likely to represent modern debris such as chain, cable, or rope, or small items of debris with no features indicating archaeological potential. Each anomaly was reviewed and interpreted to be of low archaeological potential. A further review was undertaken following the assessment of the survey area extents.
- 6.1.3 **Table 11** below provides a brief justification for the interpretation of each category of low potential anomalies. To note, the descriptions below are generalised, and each anomaly is interpreted based on individual characteristics, other anomalies within the wider area, seabed characterisation, etc.

Anomaly category	Description
Chain, cable, or rope	Features identified as chain, cable, or rope are generally identified as long, linear, or curvilinear features with little or no measurable height. The length and form will generally preclude their assessment as of a higher archaeological potential.
Likely geological	Features identified as likely geological, are generally precautionary identifications where the form is indicative of a geological feature but may be of a size, or form, which is unusual in the surrounding area.
Potential debris	Features identified as potential debris will generally display characteristics indicating anthropogenic origin, such as straight or angular edges. Boulder like features, with associated magnetic anomalies can also be categorised as potential debris.
Seabed disturbance	Features identified as seabed disturbances are where the main characteristic is a change in the seabed surface that may indicate either low lying material, or partially buried material. The potential will be determined based on the size, associated magnetic anomalies, and the surrounding environment.
Fishing gear	Features identified as fishing gear may include pot strings where small features are linked by rope like features, features with a mid-water component indicating snagged nets, or features associated with trawl scars.

Table 11: Low potential anomaly descriptions

- 6.1.4 Low potential anomalies have been assessed against all available evidence and are deemed unlikely to be of archaeological significance and as such are not discussed further within the results section of this report. The identification of an anomaly as of low archaeological potential is commensurate with the mitigation for this category - *Maintain an operational awareness of the anomaly's location and reporting through an agreed protocol for archaeological discoveries (PAD) should material of potential archaeological significance be encountered.*
- 6.1.5 The distribution of low potential anomalies is shown in **Figure 11**. Further information regarding mitigation can be found in **Section 10.1**, and a gazetteer of low potential anomalies, including positions and dimensions, can be found in Annex A – *Anomalies of archaeological potential.*

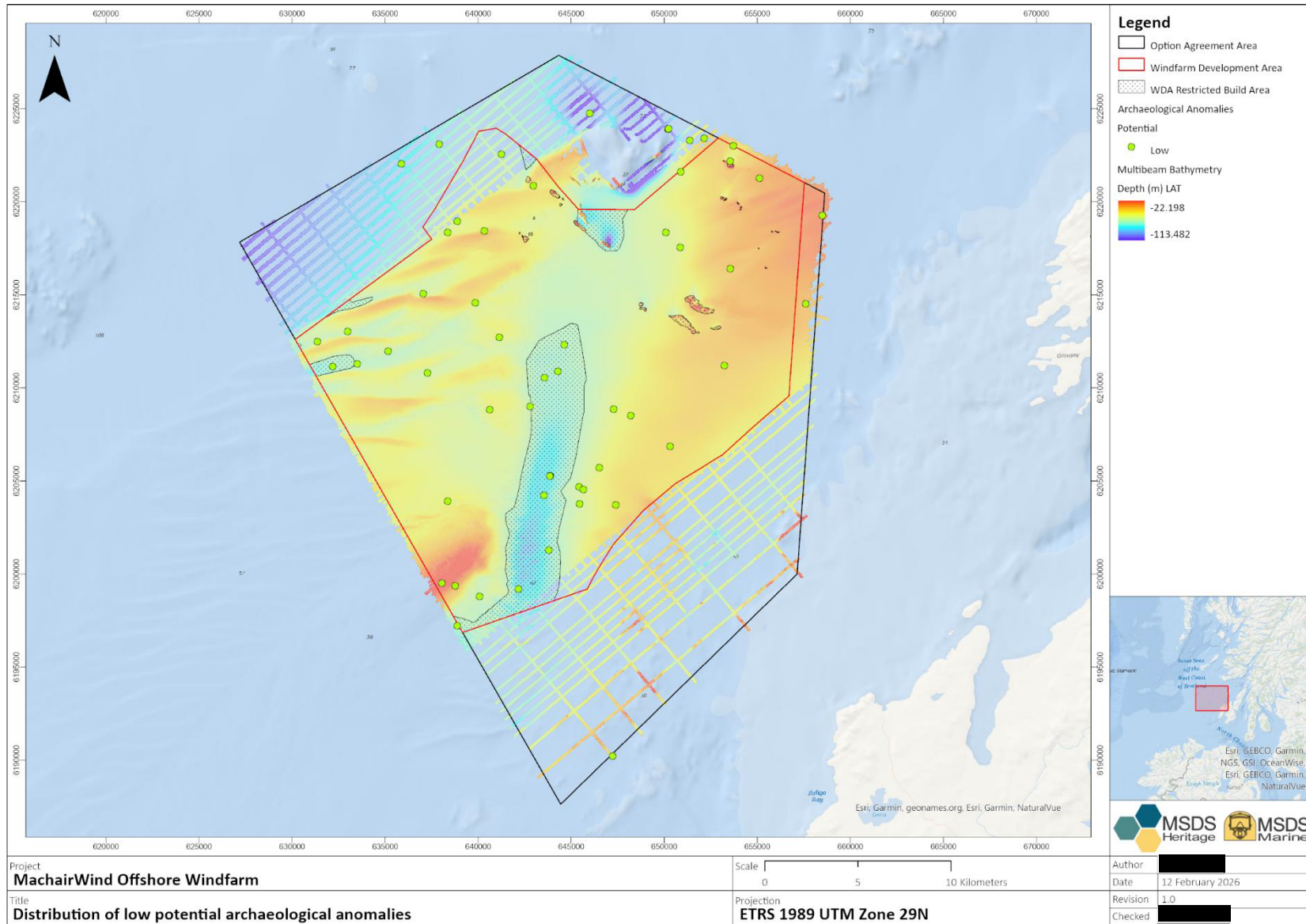


Figure 11: Distribution of Low Potential Archaeological Anomalies

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6.2 Medium potential anomalies

6.2.1 Eight anomalies interpreted as of medium archaeological potential were identified within the geophysical survey data extents, of which four lie within the WDA. The anomalies can be categorised as follows in **Table 12**, the distribution is presented in **Figure 12**.

Anomaly category	WDA	OAA	Total
Potential debris	4	4	8
Total	4	4	8

Table 12: Medium potential anomaly categories

- 6.2.2 The anomalies interpreted as of medium archaeological potential have characteristics that indicate a likelihood of representing anthropogenic material that has the potential to be of archaeological interest, or where a precautionary approach has been taken for anomalies where the identification isn't clear.
- 6.2.3 The identification of an anomaly as of medium archaeological potential is commensurate with the mitigation for this category - Avoidance of the anomaly's position and where appropriate an archaeological exclusion zone may be recommended. Ground truthing of the anomaly through the use of divers or an ROV would establish the archaeological potential.
- 6.2.4 Each medium potential anomaly is discussed, along with an image, within this section of this report. Further information regarding mitigation can be found in **Section 10.0**, and a gazetteer of medium potential anomalies, including positions and dimensions can be found in Annex A – *Anomalies of archaeological potential*.

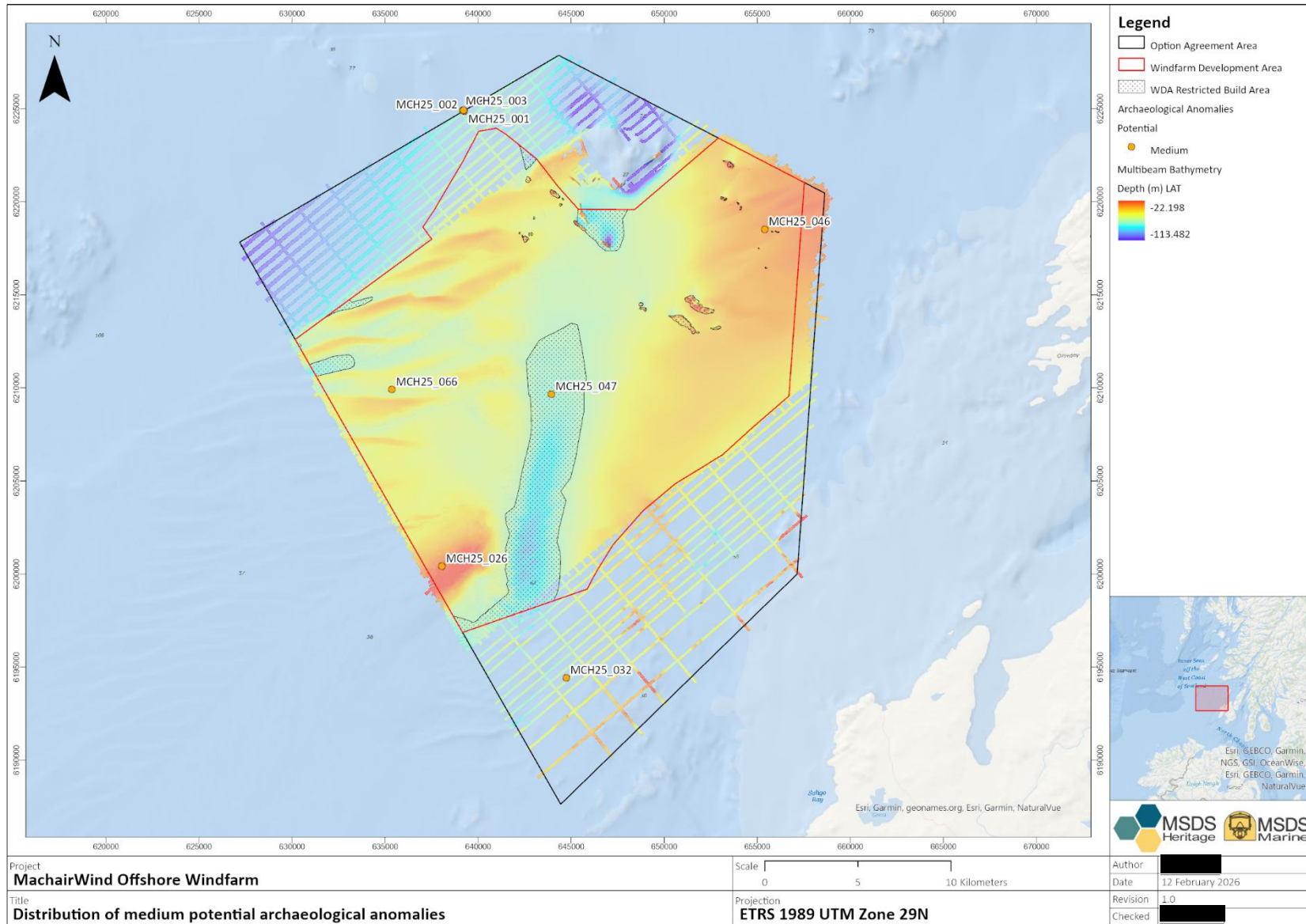


Figure 12: Distribution of Medium Potential Archaeological Anomalies

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Medium potential MCH25_001, MCH25_002, and MCH25_003

- 6.2.5 Medium potential MCH25_001, MCH25_002, and MCH25_003 (**Figure 13**) lie on the northern boundary of the OAA, c. 1.3 km outside of the WDA. The anomalies are visible in the SSS data but are outside of the MBES coverage. The anomalies have no associated magnetic anomaly, although they are bisected by a trackline. The anomaly does not correspond with any UKHO or Canmore records, the closest being UKHO 79885 4.3 km to the southwest.
- 6.2.6 The three anomalies form a triangle with a minimum distance between them of 50.5 m and a maximum distance of 74.9 m. The size, spatial distribution, and form of the anomalies potentially indicate a relationship between them. MCH25_001 measures 13.7 m x 11.1 m and is a broadly circular features comprising a number of smaller, boulder like, features around the edge. MCH25_002 measures 21.8 m x 8.3 m and is comprised of three smaller circular features arranged in a triangle to the southwest and a small mound and area of disturbed seabed to the northeast. MCH25_003 measures 10.1 m x 7.9 m and appears to be discarded Steel Wire Rope (SWR). All three anomalies potentially represent anthropogenic material, and of a size and distribution that mean a medium potential rating is appropriate. However, the origin of the anomalies is unclear although do not appear to represent a wreck and could potentially be discarded fishing gear. The anomalies lie at distance outside the WDA that means they will not be impacted by construction activities.

Medium potential MCH25_026

- 6.2.7 Medium potential MCH25_026 (**Figure 14**) lies within, and to the southwest of, the WDA c. 790 m from the western boundary, the anomaly is outside of the WDA Restricted Build Area. The anomaly is visible in both the SSS and MBES data and has no corresponding magnetic anomaly although it lies c. 26.2 m from an adjacent trackline. The anomaly does not correspond with any UKHO or Canmore records, the closest being Canmore 102627 7.3 km to the north.
- 6.2.8 The anomaly is an incoherent cluster of irregular features measuring 8.1 m x 2.8 m with a measurable height of 1.5 m. The MBES data shows a cluster of three smaller features to the west, each broadly circular with a 1.5 m diameter, and a larger broadly circular feature to the east with a diameter of c. 2.5 m. Within the SSS data the anomaly appears to be comprised of a dense concentration of a number of irregular features. The form indicates anthropogenic material; however, the origin is unclear. Whilst it could relate to modern debris, a medium potential rating is considered appropriate. Further assessment of ROV data would be required to better understand the origin, and therefore the archaeological potential.

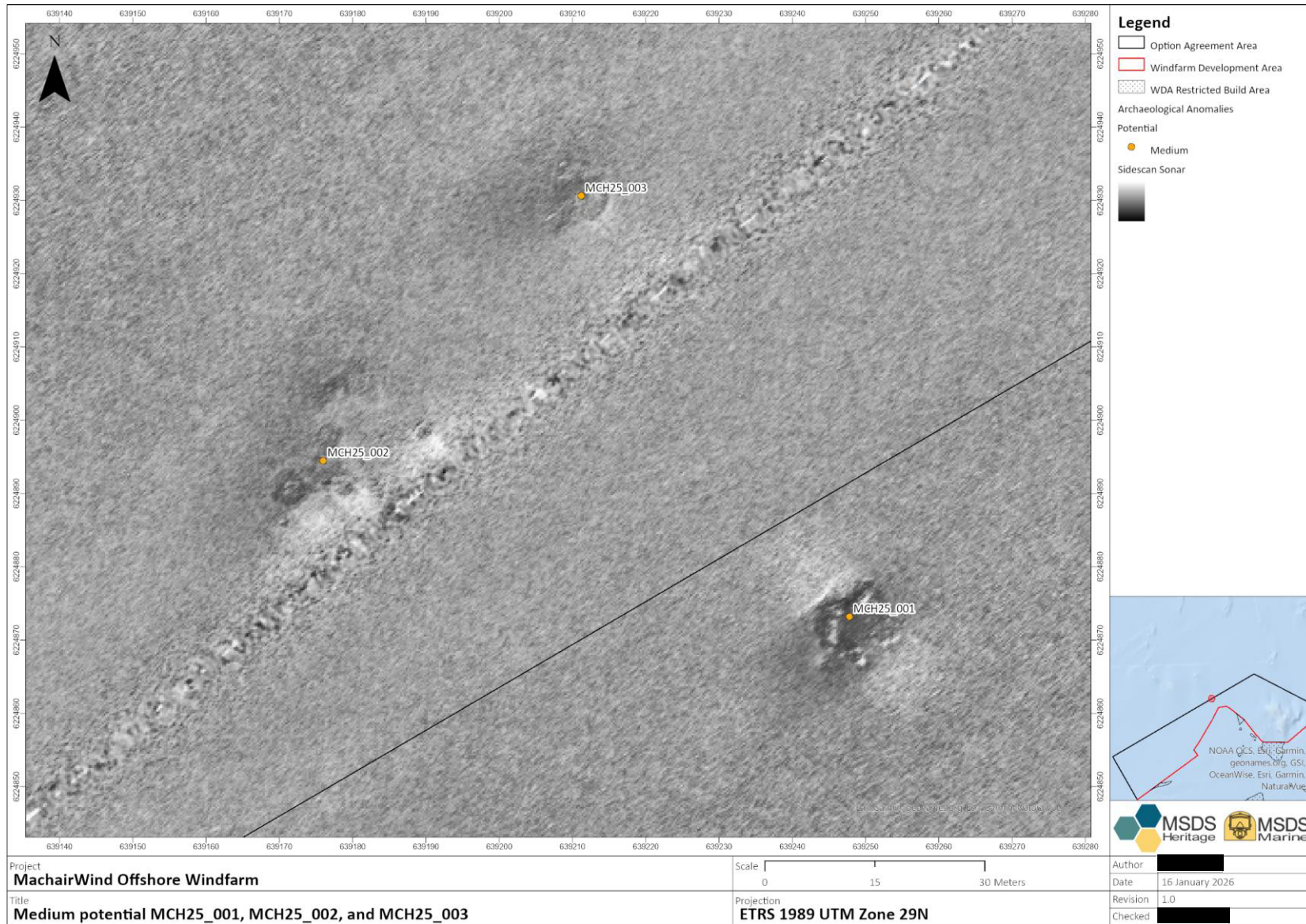


Figure 13: Medium potential MCH25_001, MCH25_002, and MCH25_003

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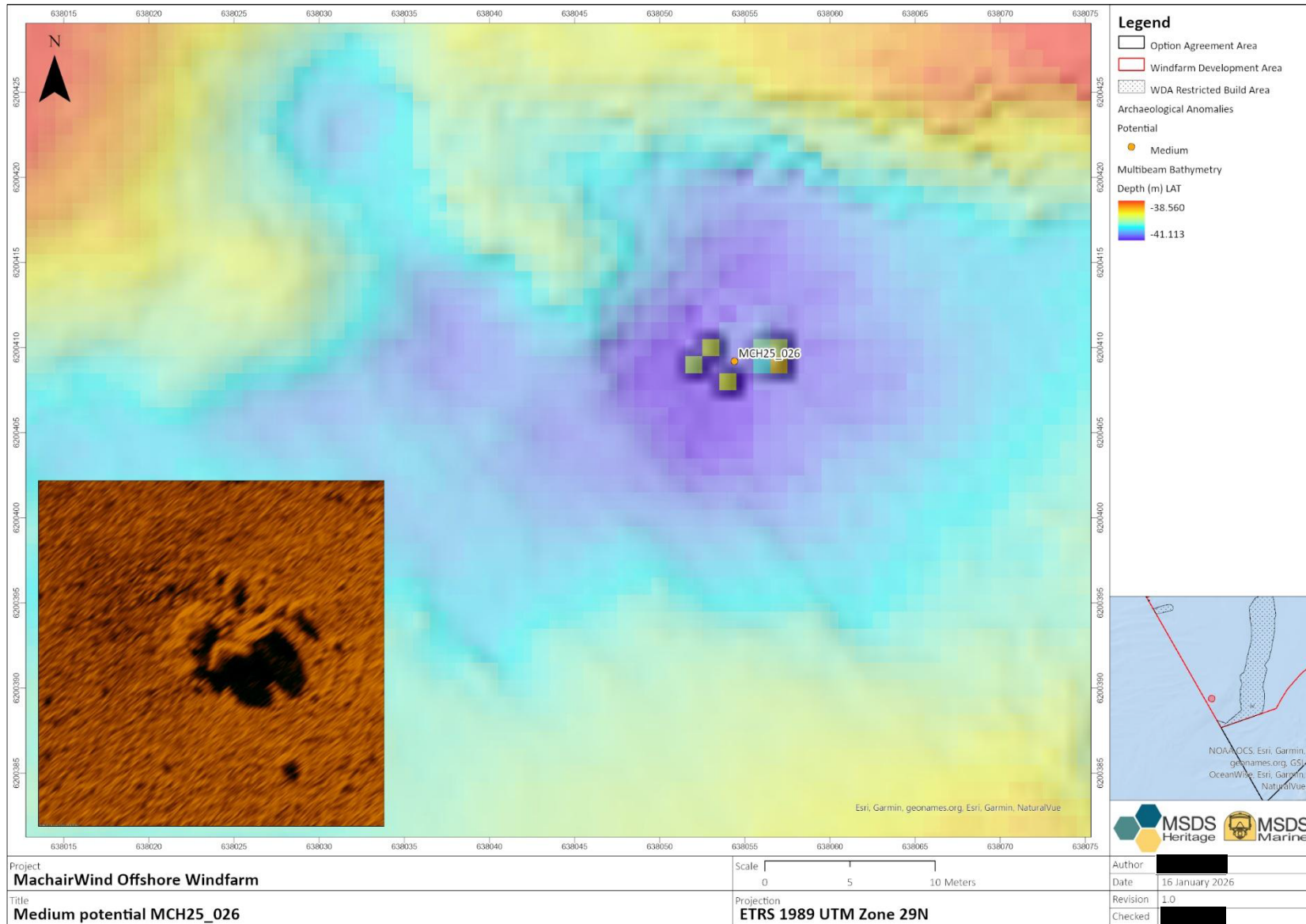


Figure 14: Medium potential MCH25_026

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Medium potential MCH25_032

6.2.9 Medium potential MCH25_032 (**Figure 15**) lies within the OAA, c. 4.1 km outside of the WDA. The anomaly is visible in the SSS data but is outside of the MBES coverage. The anomaly has no associated magnetic anomaly, although it lies c. 60.0 m from an adjacent trackline. The anomaly does not correspond with any UKHO or Canmore records, the closest being Canmore 102628 3.4 km to the south.

6.2.10 The anomaly is an area of potential anthropogenic debris measuring 32.9 m x 14.8 m with a measurable height of 0.2 m. The anomaly is partially covered by sandwaves, but appears as a distribution of small features, with some appearing linear in form. However, there is only a single line of SSS data covering the anomaly and it appears to suffer from stretching, distorting the features. The interpretation of the anomaly as of medium potential is precautionary, as it could represent both anthropogenic debris (such as the low lying and deteriorated remains of a wreck), or equally geological material. The anomaly lies at distance outside the WDA that means it will not be impacted by construction activities.

Medium potential MCH25_046

6.2.11 Medium potential MCH25_046 (**Figure 16**) lies within, and to the east of, the WDA c. 1.9 km from the eastern boundary, the anomaly is outside the WDA Restricted Build Area. The anomaly is visible in both the SSS and MBES data and has a corresponding magnetic anomaly of 26.3 nT (2,643.8 kg). The anomaly does not correspond with any UKHO or Canmore records, the closest being Canmore 256053 7.3 km to the northwest.

6.2.12 The anomaly comprises two prominent features 36.2 m apart and orientated northwest to southeast. The largest feature to the southeast measures 15.3 m x 7.8 m with a measurable height of 0.3 m (excluding the depth of scour) and is an irregular mound with a depression towards the centre, a small mound lies adjacent to the northwest, and scour is visible to the north. The smaller feature to the northwest measures 5.3 m x 4.1 m with a measurable height of 0.2 m (excluding the depth of scour) and is an ovular mound with scour visible on all sides. The origin of the anomaly is unclear, and it lies within a wider area of outcropping rock, however the form is slightly different to other examples of outcropping rock, potentially suggesting an anthropogenic origin. The presence of a significant magnetic anomaly would typically indicate anthropogenic material, however all outcropping rock within the WDA is associated with significant magnetic anomalies suggesting they are ferruginous. Further assessment of ROV data would be required to better understand the origin, and therefore the archaeological potential.

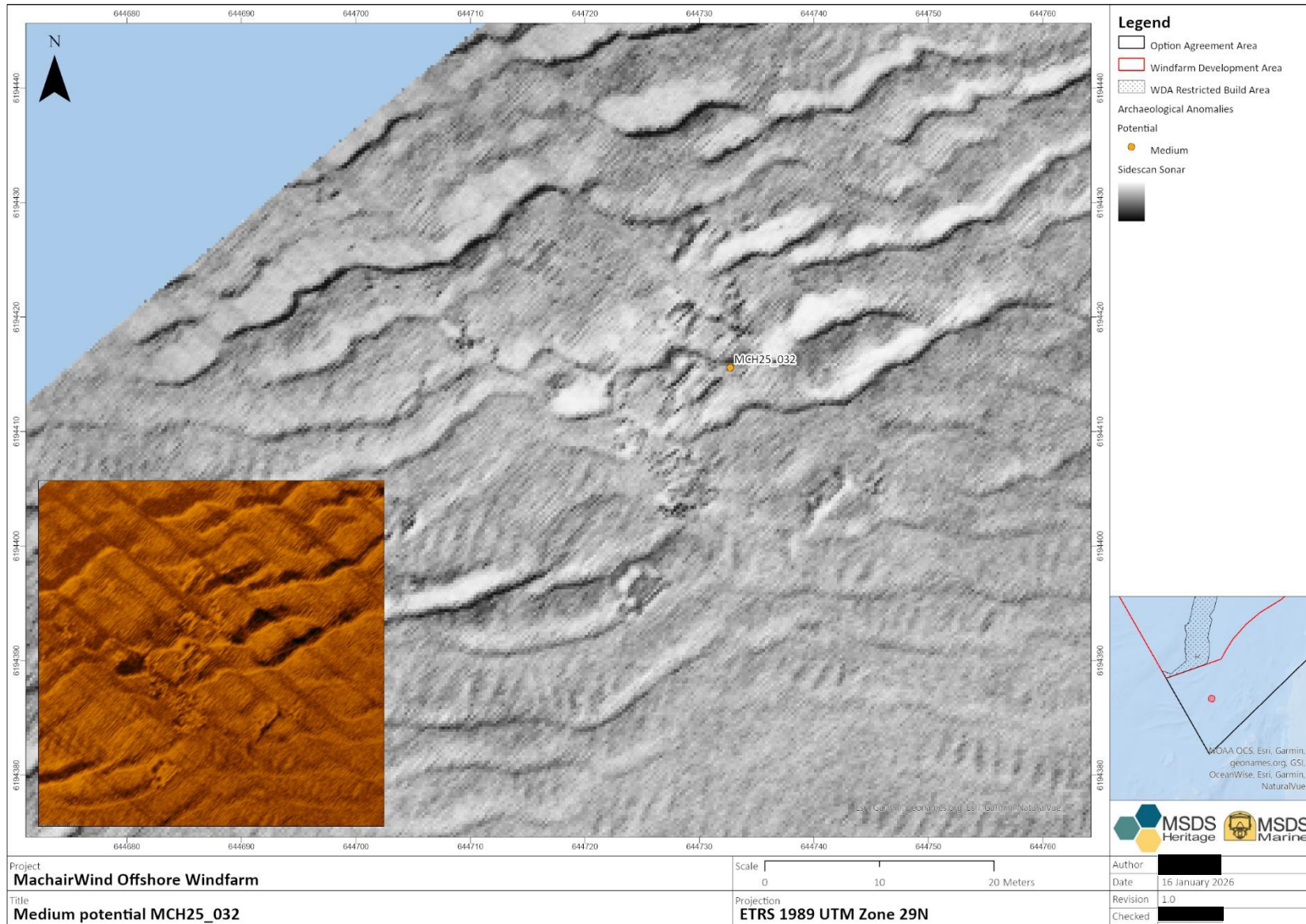


Figure 15: Medium potential MCH25_032

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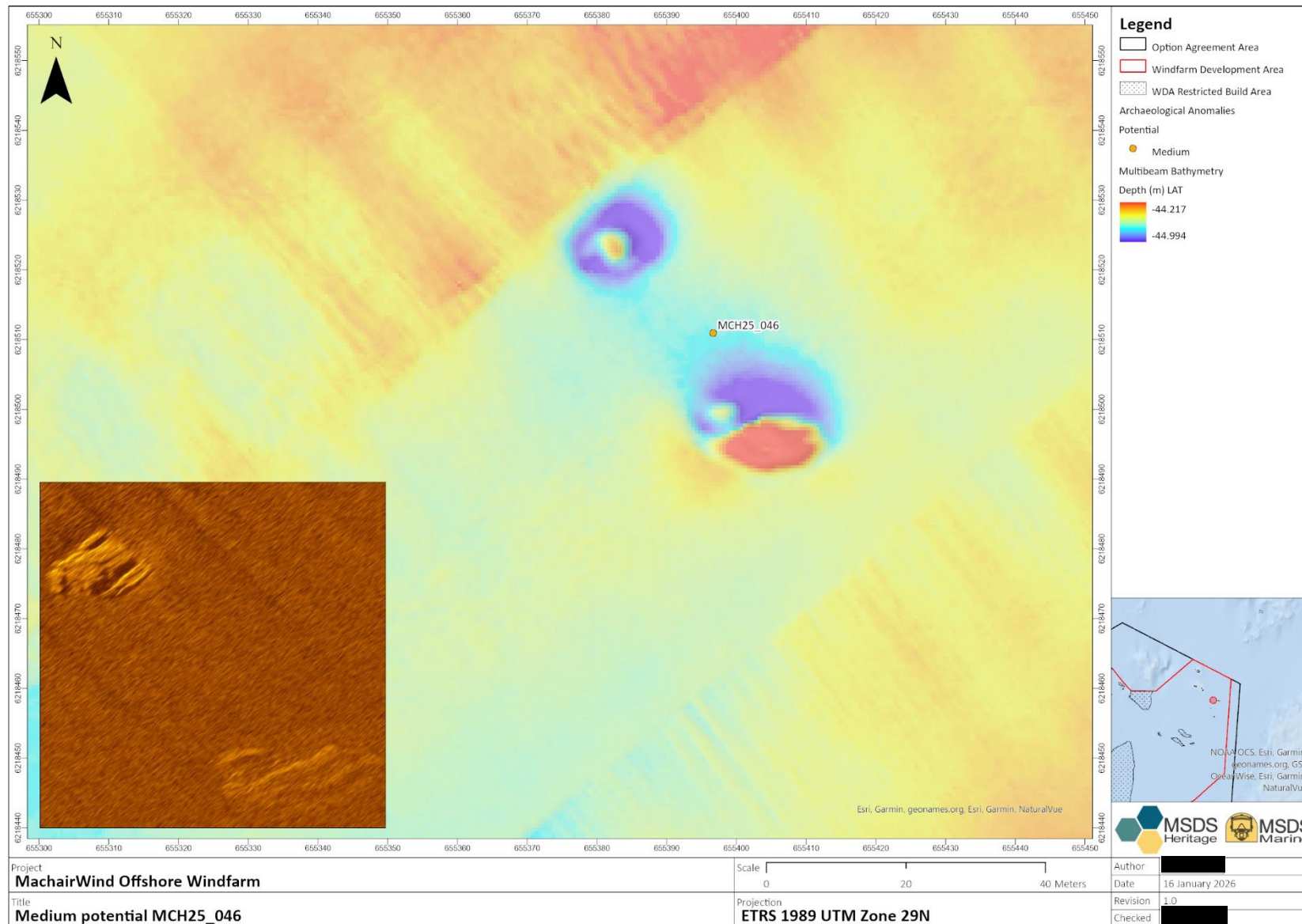


Figure 16: Medium potential MCH25_046

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Medium potential MCH25_047

6.2.13 Medium potential MCH25_047 (**Figure 17**) lies within, and towards the centre of, the WDA, the anomaly is within the WDA Restricted Build Area. The anomaly is visible in both the SSS and MBES data but is more prominent in the SSS data. The anomaly has no associated magnetic anomaly, although it lies c. 5.1 m from an adjacent trackline. The anomaly does not correspond with any UKHO or Canmore records, the closest being Canmore 102627 6.1 km to the southwest.

6.2.14 The anomaly is only faintly visible in the MBES data, and appears as an area of slight depression over an area c. 10 m x 10 m. Within the SSS data the anomaly appears as two linear feature each measuring 7.6 m with a measurable height of 0.1 m and orientated at a right angle. Smaller features are also visible creating a square. The origin of the anomaly is unclear but is likely to be of anthropogenic origin. The size of the anomaly, and the unknown origin means a medium potential rating is considered appropriate. Further assessment of ROV data would be required to better understand the origin, and therefore the archaeological potential.

Medium potential MCH25_066

6.2.15 Medium potential MCH25_066 (**Figure 18**) lies within, and to the west of, the WDA c. 3.2 km from the western boundary, the anomaly is outside the WDA Restricted Build Area. The anomaly is visible in both the SSS and MBES data and has no corresponding magnetic anomaly although it lies c. 7.1 m from an adjacent trackline. The anomaly does not correspond with any UKHO or Canmore records, the closest being Canmore 102627 3.6 km to the southeast.

6.2.16 The anomaly appears in the MBES data as three small, but prominent, mounds distributed in a linear arrangement over a length of 17.4 m. The mounds are on the edge of a sandbank which lies to the north. The smallest mound measures 1.9 m x 1.7 m with a measurable height of 0.3 m, the largest mound measures 2.7 m x 2.6 m with a measurable height of 0.4 m. Within the SSS data the overall visible length is the same, however the mounds appear more irregular and potentially comprised of a number of small features. Whilst a precautionary interpretation of medium potential, the form of the anomaly has the potential to represent material of anthropogenic origin, with the anomaly potentially partially buried by the adjacent sandbank. Further assessment of ROV data would be required to better understand the origin, and therefore the archaeological potential.

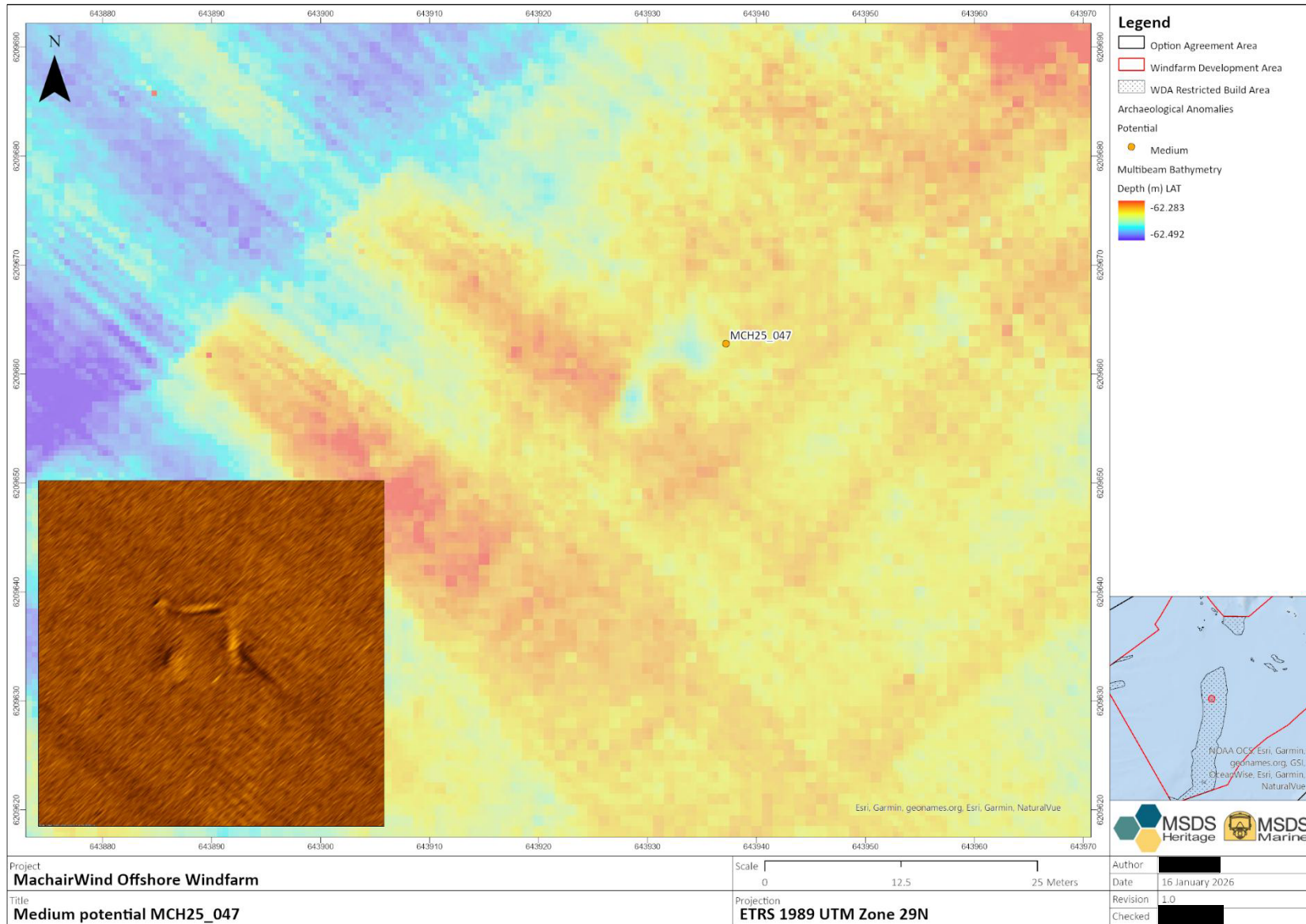


Figure 17: Medium potential MCH25_047

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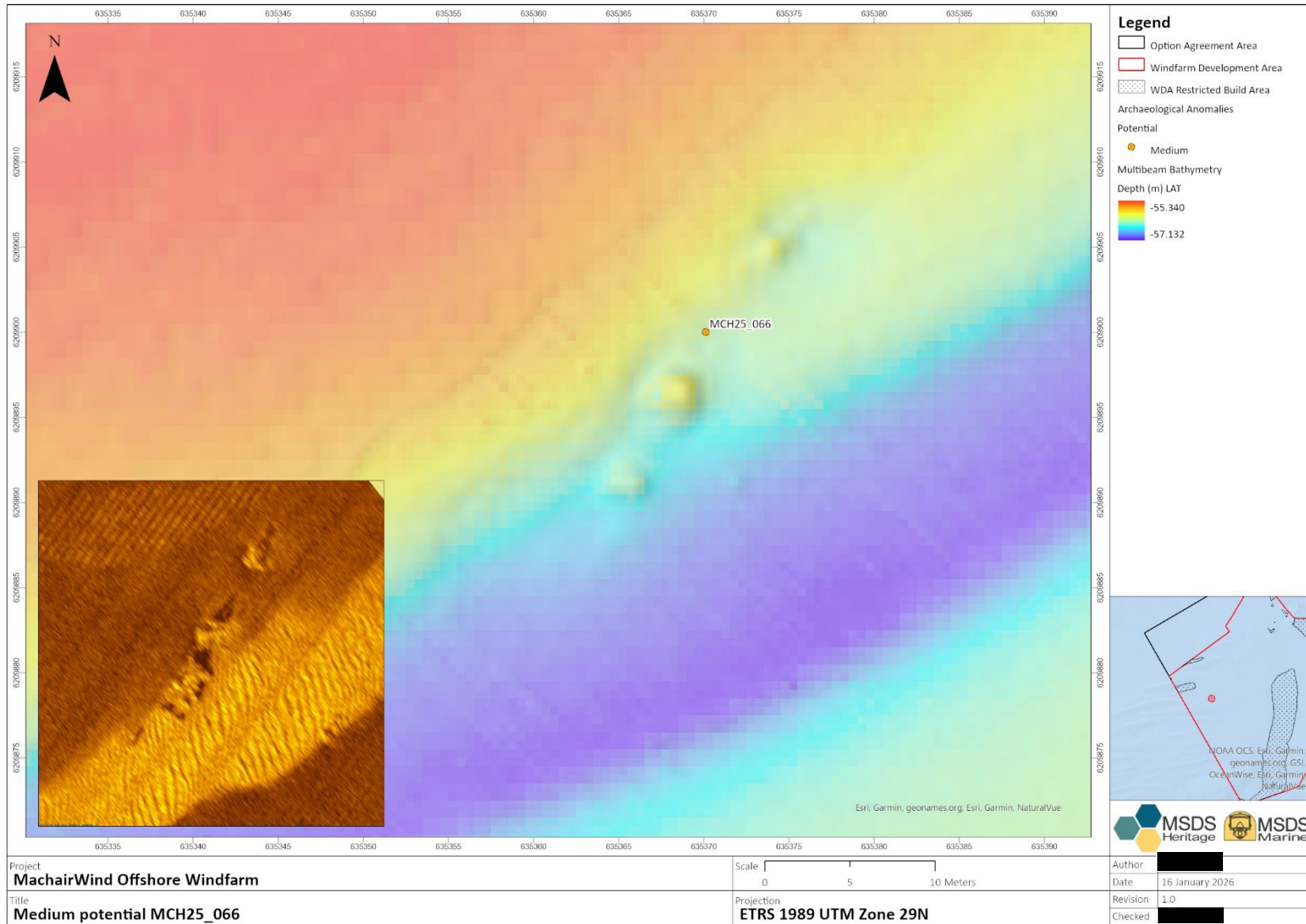


Figure 18: Medium potential MCH25_066

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6.3 High potential anomalies

6.3.1 Two anomalies interpreted as of high archaeological potential were identified within the geophysical survey data extents, one of which lies within the WDA. The anomalies can be categorised as follows in **Table 13**, the distribution is presented in **Figure 19**.

Anomaly category	WDA	OAA	Total
Wreck	1	0	1
Possible wreckage	0	1	1
Total	1	1	2

Table 13: High potential anomaly categories

6.3.2 The anomalies interpreted as of high archaeological potential have characteristics that indicate a high likelihood of representing anthropogenic material that has a high potential to be of archaeological interest.

6.3.3 The identification of an anomaly as of high archaeological potential is commensurate with the mitigation for this category - Archaeological exclusion zones will be recommended based on the size of the anomaly, any outlying debris and the seabed dynamics as interpreted from the SSS and MBES data.

6.3.4 Each high potential anomaly is discussed, along with an image, within this section of this report. Further information regarding mitigation can be found in **Section 10.0**, and a gazetteer of high potential anomalies, including positions and dimensions can be found in Annex A – *Anomalies of archaeological potential*.

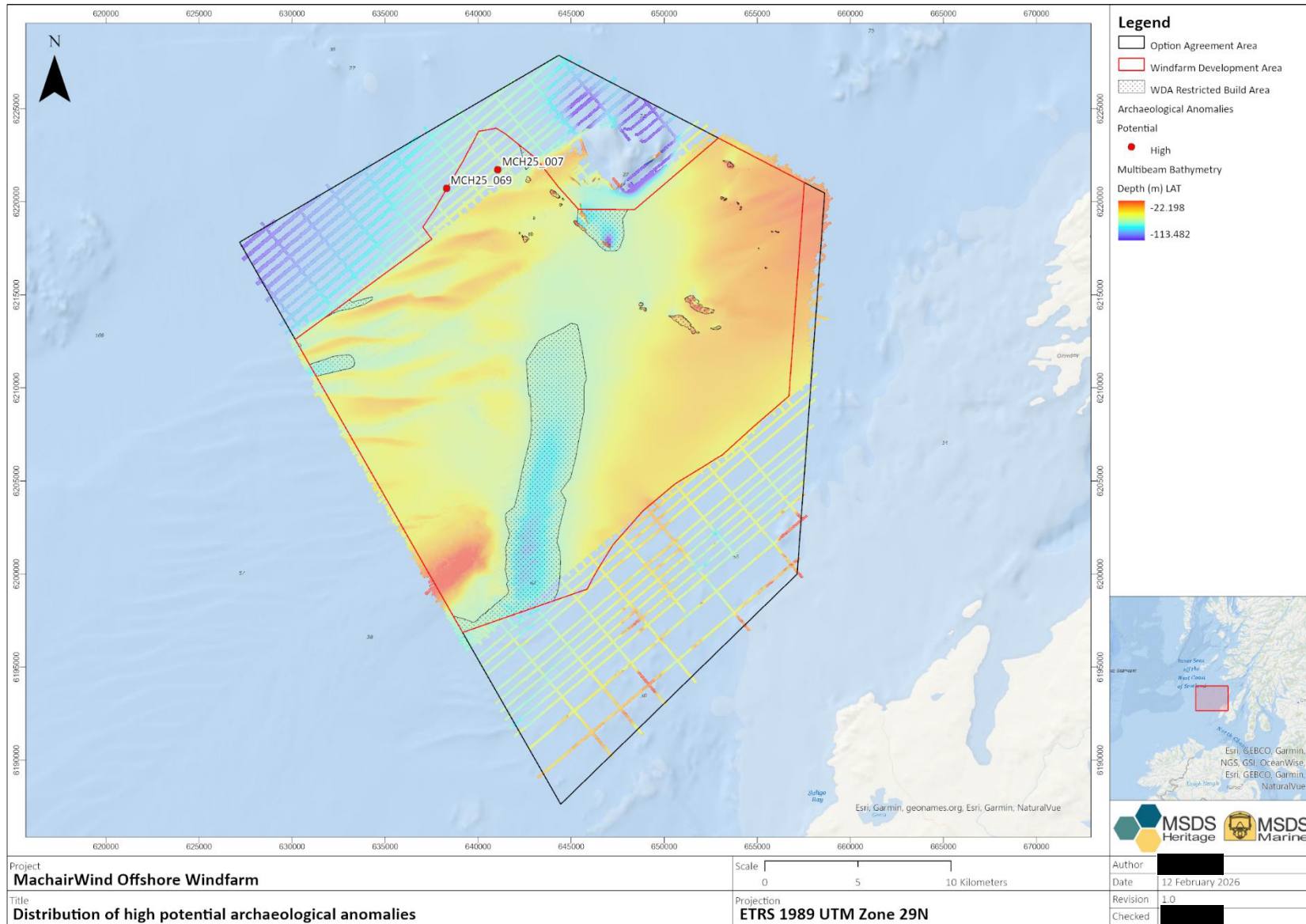


Figure 19: Distribution of High Potential Archaeological Anomalies

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High potential MCH25_007

- 6.3.5 High potential MCH25_007 (**Figure 20**) lies within, and towards the north of, the WDA, c. 2.2 km south of the northern boundary, the anomaly is outside the WDA Restricted Build Area. The anomaly lies within the 2025 data gap and is therefore only covered by the 2023 data. The anomaly is visible primarily in the SSS data (one line) with only the very edge covered by MBES data. The anomaly has no associated magnetic anomaly, although it lies c. 66.8 m from an adjacent trackline. The anomaly corresponds with UKHO record 2627.
- 6.3.6 The anomaly is the remains of a wrecked vessel with the visible extents measuring 120.4 m x 31.1 m with a measurable height of 1.3 m (noting the full extents are potentially not visible). The wreck is orientated approximately west-southwest to east-northeast; it is not clear which end is the bow. The wreck appears to be of steel construction and is largely broken up. Debris from the wreck extends up to 37.3 m from the main structure and is mainly comprised of linear features. The MBES data shows some scour along the northern edge.
- 6.3.7 The UKHO record the wreck as that of the *Eli* (possibly), a Norwegian motor vessel (cargo) built in 1931 and sunk in 1940 following an aircraft attack, the *Eli* was carrying a cargo of metal products. The as built dimensions of 116.1 m x 16.5 m correspond with those visible on the seabed. The last survey undertaken in 2011 recorded the bows to the east-northeast. The assessment of a full coverage dataset would be required to establish the extents.

High potential MCH25_069

- 6.3.8 High potential MCH25_032 (**Figure 21**) lies within the north of the OAA, c. 29 m outside of the WDA. The anomaly is partially visible in the MBES data but is outside of the SSS coverage. The anomaly has no associated magnetic anomaly, although it lies c. 128.8 m from an adjacent trackline. The anomaly potentially corresponds with UKHO record 79885 123.9 m to the south.
- 6.3.9 The anomaly is an irregular, low lying, mound measuring 13.7 m x 11.1 m with a measurable height of 0.2 m. The full extents of the anomaly are not visible within the data; it is unclear as to how far the anomaly extends to the south. Scour is visible on all sides, although it is more prominent to the east. The form of the anomaly indicates anthropogenic material; however, the origin is unclear.
- 6.3.10 The anomaly has been assigned a precautionary high potential rating due to the proximity to UKHO record 79885. The record is that of potential wreckage identified in 2011, whilst no description of the wreckage is provided the measurements are recorded as 48 m x 28 m with a height of 2.1 m. There is potential for the record position to be wrong (although this is less likely for positions originating in 2011), or for the extents of the recorded feature to be greater than that recorded due to sediment movement. Therefore, the potential exists that the anomaly is part of a larger feature, that could represent a wrecked vessel. The assessment of a full coverage survey would be required to establish the extents, and the relationship (if any) to UKHO record 79885.

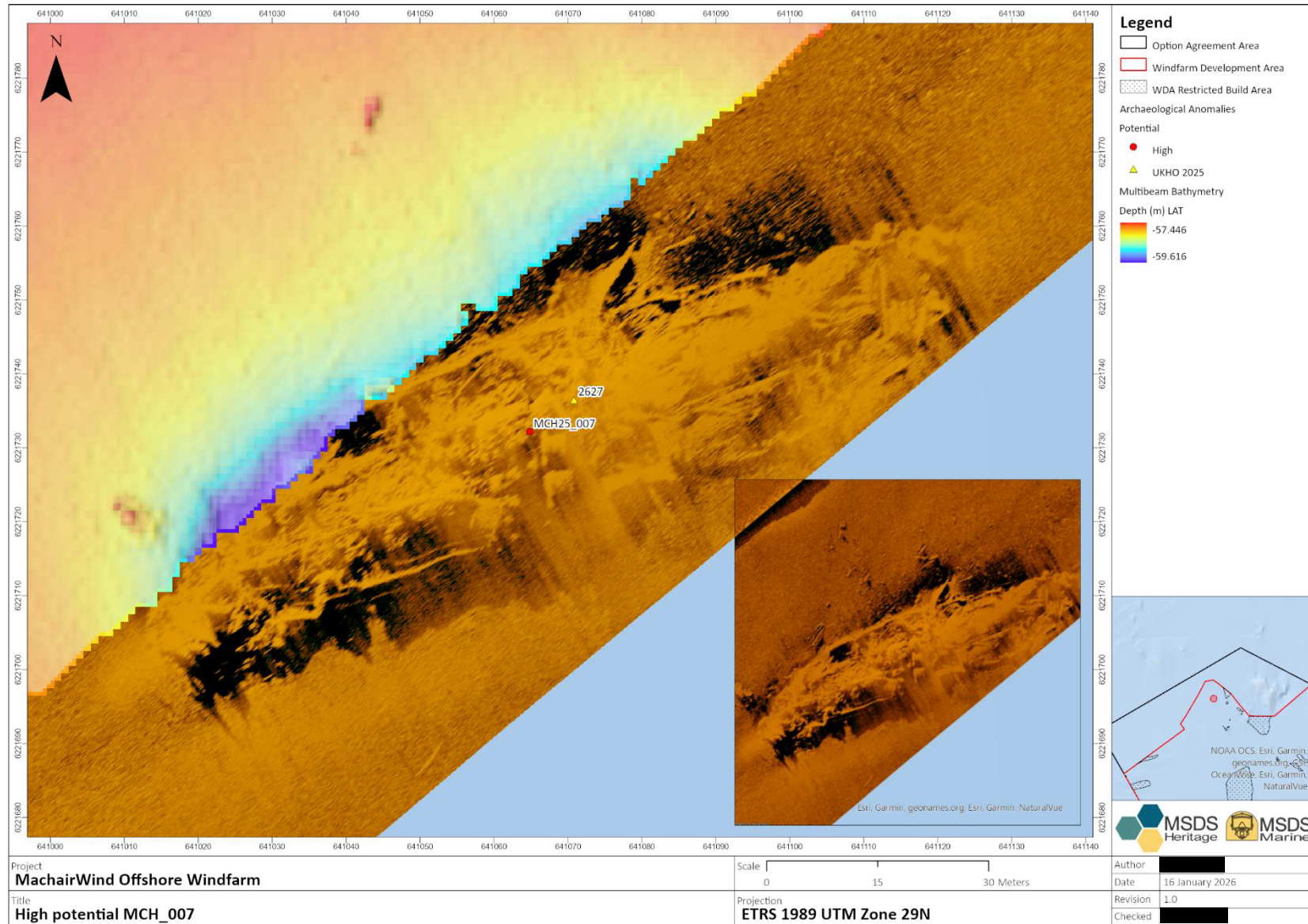


Figure 20: High potential MCH25_007

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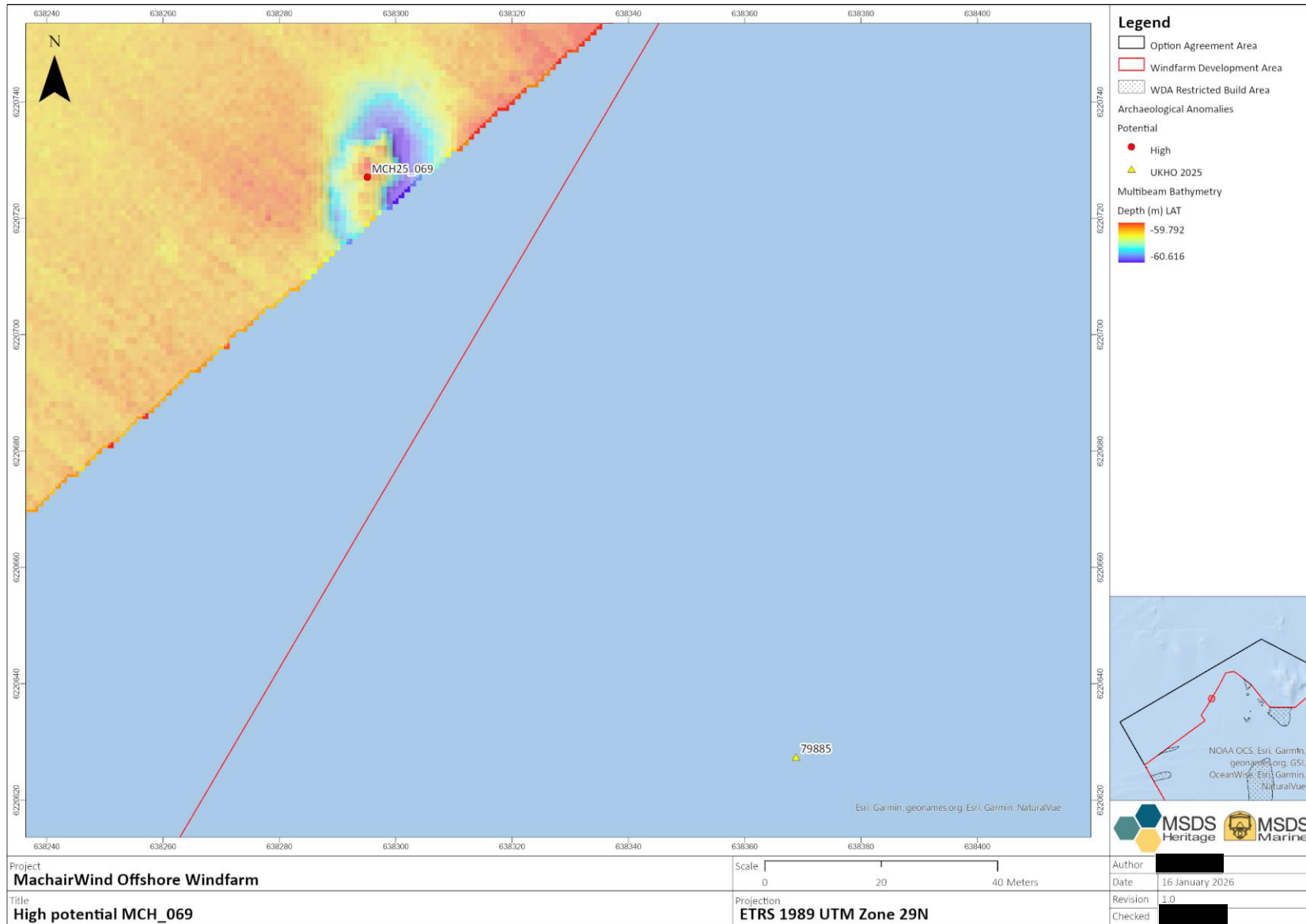


Figure 21: High potential MCH25_069

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7.0 Magnetic anomalies

7.0.1 369 magnetic anomalies, ranging between 5.0 nT and 730.6 nT, were identified within the geophysical survey data extents, of these 334 do not correlate with known, or visible, features or infrastructure. The distribution of anomalies by amplitude is shown below in **Table 14** with their spatial distribution presented in **Figure 22**.

Amplitude (nT)	WDA	OAA	Total
5 to 50	242	45	287
50 to 100	22	3	25
100 to 200	13	1	14
200 +	8	0	8
Total	285	49	334

Table 14: Magnetic anomalies by Amplitude (nT)

7.0.2 Anomalies identified from the magnetometer data are ferrous and thus generally anthropogenic in origin although they can be associated with geological features, however, there is no visual interpretation as with other geophysical data.

7.0.3 The magnetometer data collection methodology across the geophysical survey data extents was to run lines concurrently with the SSS and MBES, thus the line spacing is not sufficient for the detailed assessment of small, ferrous features on or below the seabed. The position for a magnetic anomaly can only be determined from directly below a single sensor, or where lines are run close enough together to be able to confidently position an anomaly seen on two, or more, lines. However, in combination with SSS and MBES data the magnetometer specification is considered sufficient to develop a broad understanding of the potential of the survey area, and to identify larger features of potential archaeological significance.

7.0.4 The positions of magnetic anomalies were viewed in the available datasets and where there was a strong correlation with a seabed anomaly, they were assessed for archaeological potential. All remaining anomalies have been included within this section.

7.0.5 All isolated magnetic anomalies of 50 to 100 nT or less are considered to be of limited potential to be of archaeological significance. This is however dependent on the distance from the sensor.

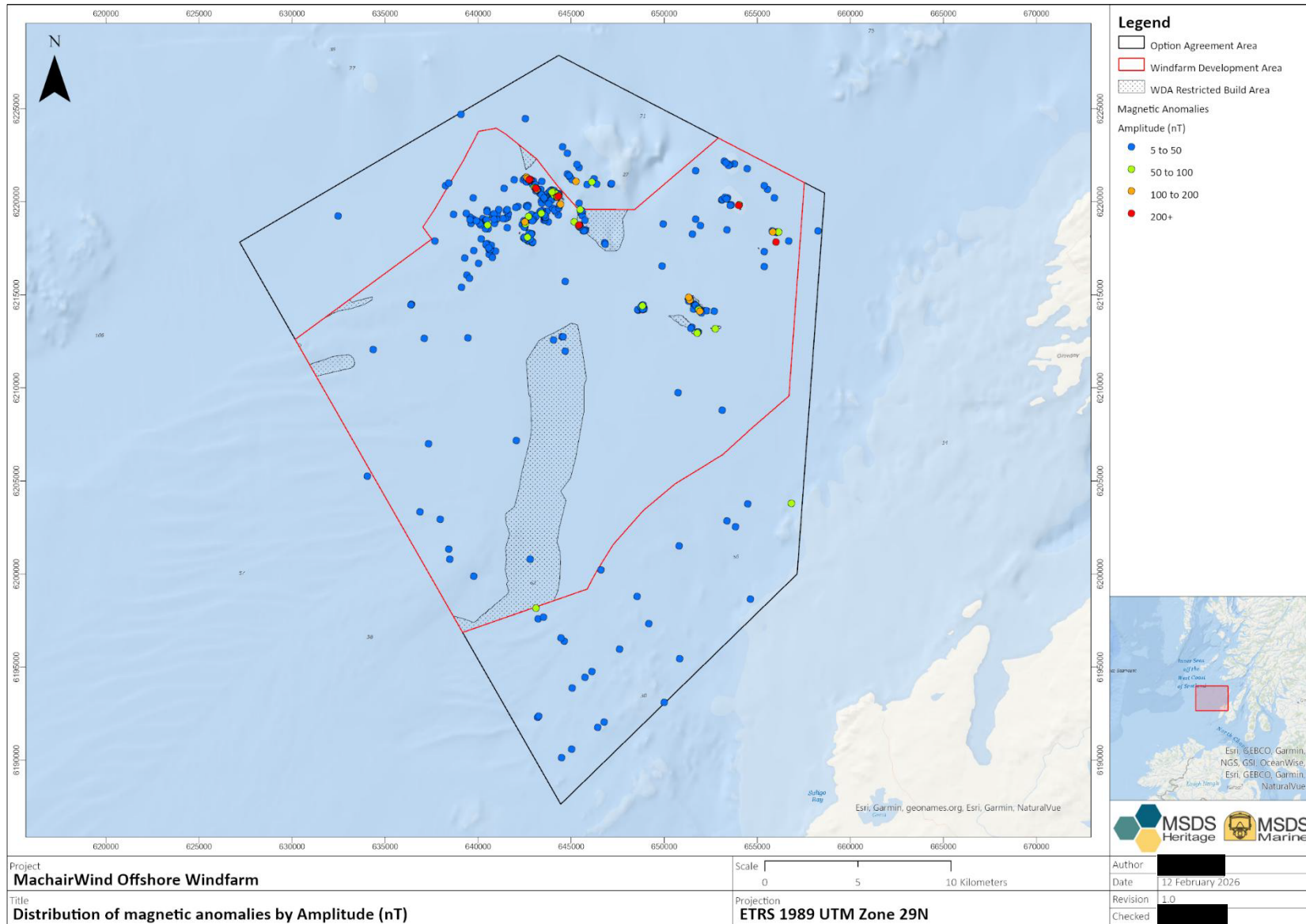


Figure 22: Distribution of magnetic anomalies by Amplitude (nT)

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7.1 Calculation of mass

- 7.1.1 The presentation, and categorisation, of magnetic anomalies by amplitude (nT) provides an effective way to gain a broad understanding of the distribution of ferrous material on, or just below, the seabed. However, to understand the data more comprehensively the ferrous mass needs to be calculated which is based on the amplitude and the distance from the magnetometer. However, with a line spacing of 100 m this is not possible to undertake accurately for anomalies that are not visible on the surface or visible on two lines of data, due to the potential distance of an anomaly from the magnetometer ranging from the altitude to the slant range of 50% of the line spacing (50.0 m range is equal to 51.0 m slant range at 10.0 m altitude).
- 7.1.2 Therefore, all calculations of mass are made using the assumption the anomaly lies directly below the magnetometer, with the distance used for the calculation being equal to the recorded altitude of the magnetometer. Furthermore, calculations are made assuming an anomaly ratio of 1:1. The distribution of anomalies by estimated mass is shown below in **Table 15** with their spatial distribution presented in **Figure 23**.

Estimated mass (kg)	WDA	OAA	Total
1 to 100	1	0	1
100 to 500	35	14	49
500 to 1,000	68	13	81
1,000 +	181	22	203
Total	285	49	334

Table 15: Magnetic anomalies by ferrous mass (kg)

- 7.1.3 As can be noted, the distribution (quantities) of the anomalies by estimated mass is broadly the reverse of that for amplitude. This is a direct result of the altitude of the magnetometer during the survey, with the mean altitude being 9.9 m. At an altitude of 9.9 m and an amplitude of 5.0 nT the estimated ferrous mass would be 485 kg, with an amplitude of 25 nT this increases to an estimated ferrous mass of 2,426 kg. Thus, the limitations of a magnetometer survey at these altitudes can be clearly noted.
- 7.1.4 Typically, and dependant on the survey specification and the distance from the target, isolated anomalies under 50 to 100 nT or 500 kg are considered to be of limited, or low, potential to be of archaeological significance.

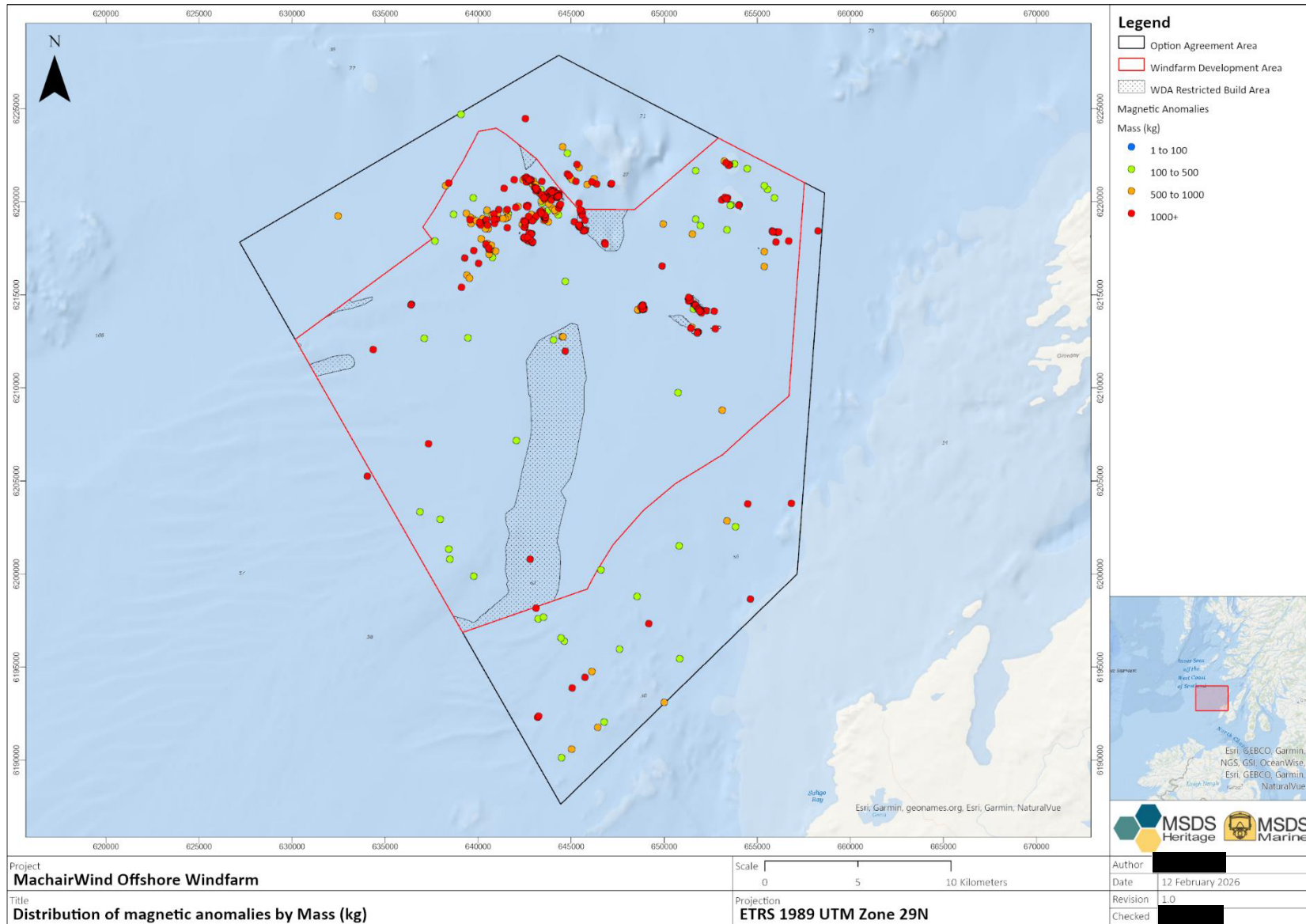


Figure 23: Distribution of magnetic anomalies by mass (kg)

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7.2 Overview of magnetic anomaly distribution

- 7.2.1 The distribution of magnetic anomalies is fairly uniform within the extents of the magnetometer data, primarily consisting of anomalies <50 nT and >500 kg. Due to the 100 m line spacing, and the altitude used during data collection, this is a fairly typical distribution, both geographically and in terms of recorded amplitude.
- 7.2.2 The size (in nT) of a magnetic anomaly is dependent on both the mass of ferrous material, and the distance from the sensor. Therefore, unless there is a strong correlation between a magnetic anomaly and a seabed feature perpendicular to the track, it is not possible to accurately position or determine the mass of an anomaly. For example, an anomaly of <50 nT relating to a feature direct below the track could, and often does, represent small pieces of debris, steel cable, fishing gear, etc. whilst an anomaly of <50 nT 100.0 m from the track could indicate a much larger feature. If that feature is not visible in the other geophysical datasets (potentially due to being buried) then the position is unable to be reconciled. As such, a bias towards anomalies <50 nT is expected as the range to the sensor is greater than 25 m for 50% of the seabed at a 100 m line spacing.
- 7.2.3 The potential ferrous mass of anomalies has been calculated, however with a line spacing of 100 m the accuracy of this is extremely limited, primarily due to the unknown distance from the magnetometer to the anomaly. The quantity of significant magnetic anomalies (in terms of ferrous mass) is unusual and is highly unlikely to represent an abnormal amount of ferrous anthropogenic material on the seabed. Assessment of the location of the magnetic anomalies against the visible rock outcrops has determined that 48% of them lie on, or within 100 m, of them, with the majority of the remaining anomalies clustered to the north of the WDA, where the highest concentration of outcrops is visible. It is therefore highly likely that the underlying (and sometimes visible) geology has a significant ferrous content.

7.3 Discussion of potential

- 7.3.1 Magnetic anomalies >100 nT are typically described as large and have the potential to be of archaeological significance. It should be noted that these anomalies, and any interpretations, are based on a magnetic signature rather than a visible image of the anomaly on the seabed. It is often the case that during intrusive investigations these anomalies are identified as modern marine debris, including cable, chain, modern anchors, fishing gear, and parts of modern vessels such as outboard engines, and other detritus either deliberately or accidentally, put overboard. Where anomalies are largely isolated, or relating to a single feature, the most commonly identified material of archaeological interest are isolated anchors, often of indeterminate age. The difficulties in determining the age of concreted anchors, and the lack of a wider context means these are often classed as of low or medium potential to be of archaeological significance. However, whilst the chances of isolated magnetic anomalies being of archaeological interest is potentially low, this does not reduce the potential of anomalies to be of archaeological significance, and both must be considered during the recommendation of mitigation (**Section 10.0**).
- 7.3.2 As discussed, given the vagaries with positioning, size, etc. as well as impacts of the underlying geology it would not be proportional to assign potential, and therefore mitigation of avoidance, to anomalies where there is no correlating seabed feature - the anomalies to which this section

pertains. Therefore, a broad statement of potential is provided below, and mitigation discussed further in **Section 10.0**.

- 7.3.3 285 magnetic anomalies of between 5.0 nT and 730.6 nT, and 1.1 kg and 1,217.3 kg, with no definitive correlation with archaeological anomalies, seabed features, or infrastructure, have been identified within the WDA. Magnetic anomalies are ferrous and thus generally anthropogenic in origin, or as a result of geology with a high ferrous content. Anthropogenic material has the potential to be of archaeological significance. Therefore, there is broad potential to identify additional material of potential archaeological interest within the extents of the geophysical survey data.
- 7.3.4 At the line spacing of the survey (c.100 m) the potential for anomalies of a significant mass to lie, either undetected, or underestimated is high. For example (using Hall's Equation and a minimum reliable detection limit of 5.0 nT) the minimum mass that can be identified at 5.0 nT at a range of 27.0 m is calculated as 10.0 tons, Holt (2019)⁷. Holt also notes that the results of field-testing using divers has demonstrated that Hall's Equation can have errors in the calculation of mass in some instances by a factor of three, potentially due to the magnetism of the anomaly, known as permanent or residual magnetism. Therefore, calculations should be considered as estimations of mass, not precise measurements of mass. However, they remain a more robust indication of archaeological potential than the presentation of amplitude with no supporting distance from the anomaly data.
- 7.3.5 Based on the experience of MSDS Marine, and the visual inspection of a significant number of magnetic anomalies, it is our opinion that a mass range of 500 - 1,000 kg (and above) presents a robust but proportional mass from which mitigation recommendations can be based in most instances.
- 7.3.6 The above discussion highlights the importance of the archaeological assessment of high specification (low altitude, tighter line spacing) magnetometer data, to identify the presence of anomalies of potential archaeological interest in areas that will be directly impacted by development. This is discussed further in **Section 10.0**.

⁷ Holt, P 2019. *Marine Magnetometer Processing*. 3H Consulting Ltd

8.0 United Kingdom Hydrographic Office (UKHO) Data

- 8.0.1 UKHO data from 2025 were obtained for the extents of the geophysical survey data, for correlation with anomalies identified within the geophysical data, and the establishment of TAEZs.
- 8.0.2 Five UKHO records (two of which are classed as *dead* and one as *lifted*) were identified within the OAA, four of which are within the WDA.
- 8.0.3 The categories of records, along with record counts (*dead* record counts in brackets), are detailed in **Table 16**, and the distribution presented in **Figure 24**.

Record type	WDA	OAA	Total
Wreck	2 (1)	1 (1)	3 (2)
Possible wreckage	1 (0)	0 (0)	1 (0)
Seabed frame	1 (0) (<i>lifted</i>)	0 (0)	1 (0)
Total	4 (1)	1 (1)	5 (2)

Table 16: UKHO records by type within the OAA extents

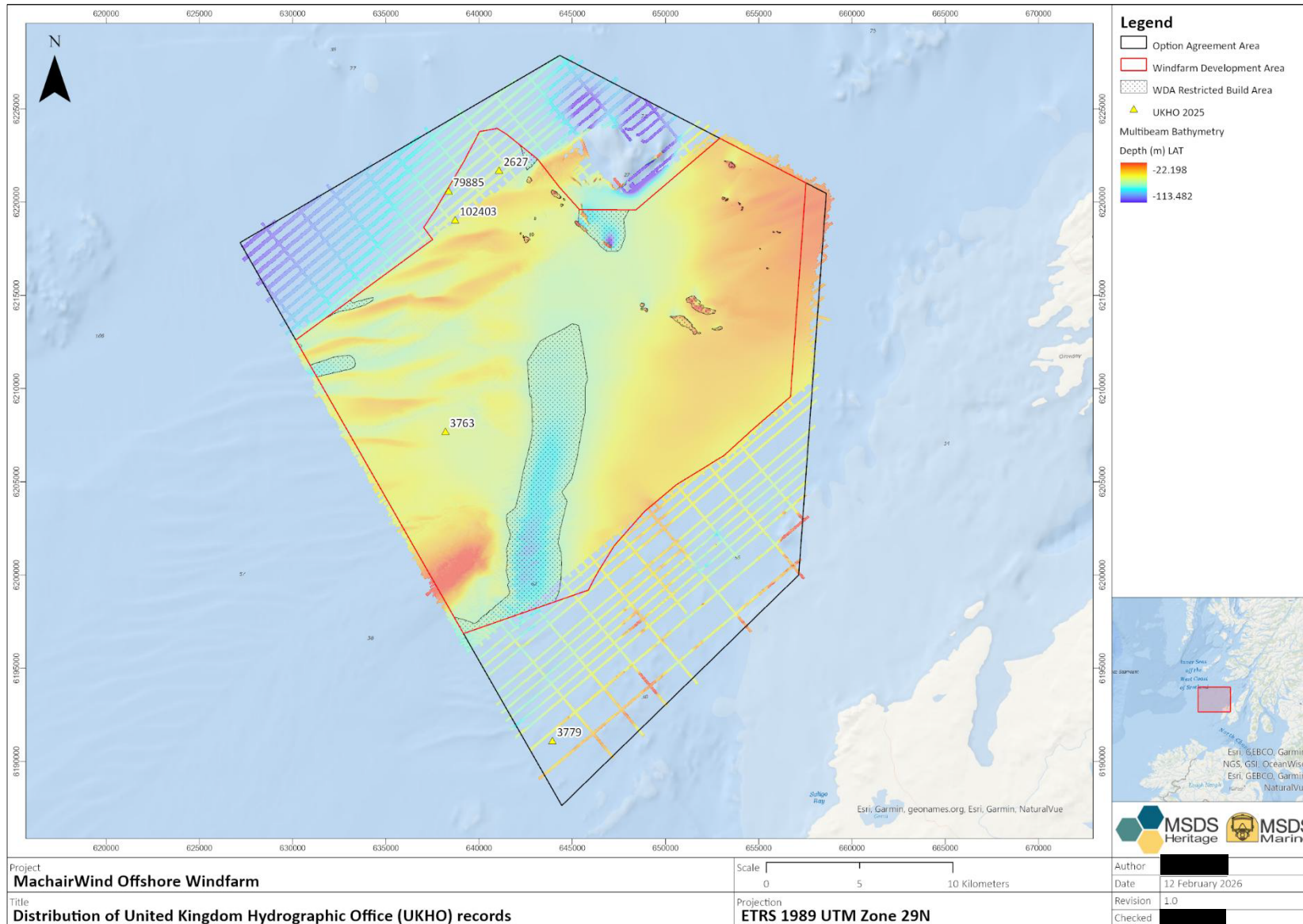


Figure 24: Distribution of United Kingdom Hydrographic Office (UKHO) records

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8.1 UKHO Records of Wreck

8.1.1 Of the five UKHO records identified, four are records of wreck or wreckage. UKHO data typically, where known, lists information about the wreck, the circumstances of its loss, surveying details, and whether the record is considered live or dead. A dead record is one which has *not been detected by repeated surveys, therefore considered not to exist*⁸. Whilst the decision to amend a wreck to dead is based on data available from repeat surveys, records can be amended for a number of reasons including:

- Deterioration of the wreck to such a degree that it no longer exists on the seabed;
- Continual burial of the wreck so that the presence is not detected over repeat surveys;
- The identification of the wreck as a natural feature; or perhaps most commonly,
- The wreck not existing at the listed location due to inaccurate reporting or positioning at the period of identification.

8.1.2 The position of the UKHO records were reviewed in the data, where there was coverage, and an assessment made as to whether they were visible, or likely to exist on the seabed. The UKHO records relating to wreck are summarised in **Table 17** and a description of each wreck provided below.

Record	Status	Name	Date sank	Date recorded	Last surveyed	In data	WDA
3763	dead			1975	2013	No	Yes
3779	dead			1985	2008	Outside	No
79885				2011		Potentially	Yes
2627		Eli (poss)	1940	1940	2011	Yes	Yes

Table 17: UKHO records of wreck within the geophysical survey data extents

UKHO record 3763

8.1.3 UKHO record 3763 lies within the WDA, and outside the WDA Restricted Build Area, c. 4.6 km east of the western boundary. The record relates to an unknown wreck identified on National Hydrographic Office/Authority charts in 1975, the area was surveyed in 2013 and the record amended to dead. No further information is given. Given the likely inaccurate position from which the record originated, and the lack of evidence within the geophysical and hydrographic data, it is highly unlikely that the remains of the vessel lie at the stated position.

UKHO record 3779

8.1.4 UKHO record 3779 lies within the OAA, outside of the WDA c. 7.3 km south of the southern boundary. The record relates to an unknown wreck (noting the record description records a 'seabed feature' and notes that the feature is almost certainly a rock pinnacle) of 50 m length first identified in 1985, the area was surveyed in 2008 and the record amended to dead. No

⁸ <https://www.wrecksite.eu/ukhoAbbrev.aspx>

further information is given. The record lies outside the extents of the geophysical data; therefore, no assessment can be made as to whether anthropogenic material is present at the location.

UKHO record 79885

8.1.5 UKHO record 79885 was potentially identified during this assessment as high potential MCH25_069 and is discussed as such in **Section 6.0**. The record lies outside the extents of the geophysical data; therefore, no assessment can be made as to whether anthropogenic material is present at the location.

UKHO record 2627

8.1.6 UKHO record 2627 identified during this assessment as high potential MCH25_007 and is discussed as such in **Section 6.0**.

8.2 UKHO records (other)

8.2.1 Of the five UKHO records identified, one is the record of a seabed frame, the record is discussed below.

UKHO record 102403

8.2.2 UKHO record 102403 lies within the WDA, and outside the WDA Restricted Build Area, c. 5.2 km south of the northern boundary. The record relates to a seabed frame deployed in 2023 (UK Notice to Mariners 3617/23). The frame is recorded as being lifted in 2024. The record lies outside of the data coverage so no assessment can be made as to whether anthropogenic material remains on the seabed, however it is not considered to be of archaeological interest.

9.0 Canmore

9.0.1 Canmore data was obtained in October 2025 for the extents of the OAA, for correlation with anomalies identified within the geophysical data and the establishment of TAEZs, as necessary.

9.0.2 These data comprise two datasets: ‘Canmore Points’ and ‘Canmore Maritime’. Canmore Points generally mark terrestrial records, although some lie within the intertidal zone and offshore. No Canmore Points are recorded within the survey extents. Seven Canmore Maritime records lie within the OAA, of which three lie within the WDA. The distribution of Canmore records is presented in **Figure 25** and summarised in **Table 18**.

Record	Position	Name	Sunk	Type	Located	In data	WDA
102627	UKHO	Unknown	Unknown	Wreck	Dead	Yes	Yes
102628	UKHO	Unknown	Unknown	Wreck	Dead	No	No
220734	NLO	<i>Stanley</i>	1902	Wreck	No	Yes	Yes
256053	NLO	<i>Caspian</i>	1874	Wreck	No	No	No
294793	NLO	Unknown	1836/1936	Wreck	No	No	Yes
301336	NLO	<i>Daneland</i>	1941	Wreck	No	No	No
329519	NLO	<i>Handley Page</i>	1943	Aircraft	No	No	No

Table 18: Canmore records

General note on Named Locations (NLOs)

9.0.1 Named Locations (NLOs) are arbitrary positions, the point of which is deemed to be closest to the position of a wrecking event. The positions may have originated from a number of sources, including documentary records, and accounts of sinking (either from the crew or third parties). It is usual for a number of records to be assigned to the same location.

9.0.2 Whilst the positions, and the surrounding areas, are reviewed within the geophysical datasets typically no remains are expected at the given locations. The presentation of NLOs serves to characterise the potential within the area for remains of wrecks, and/or aircraft to be present on the seabed.

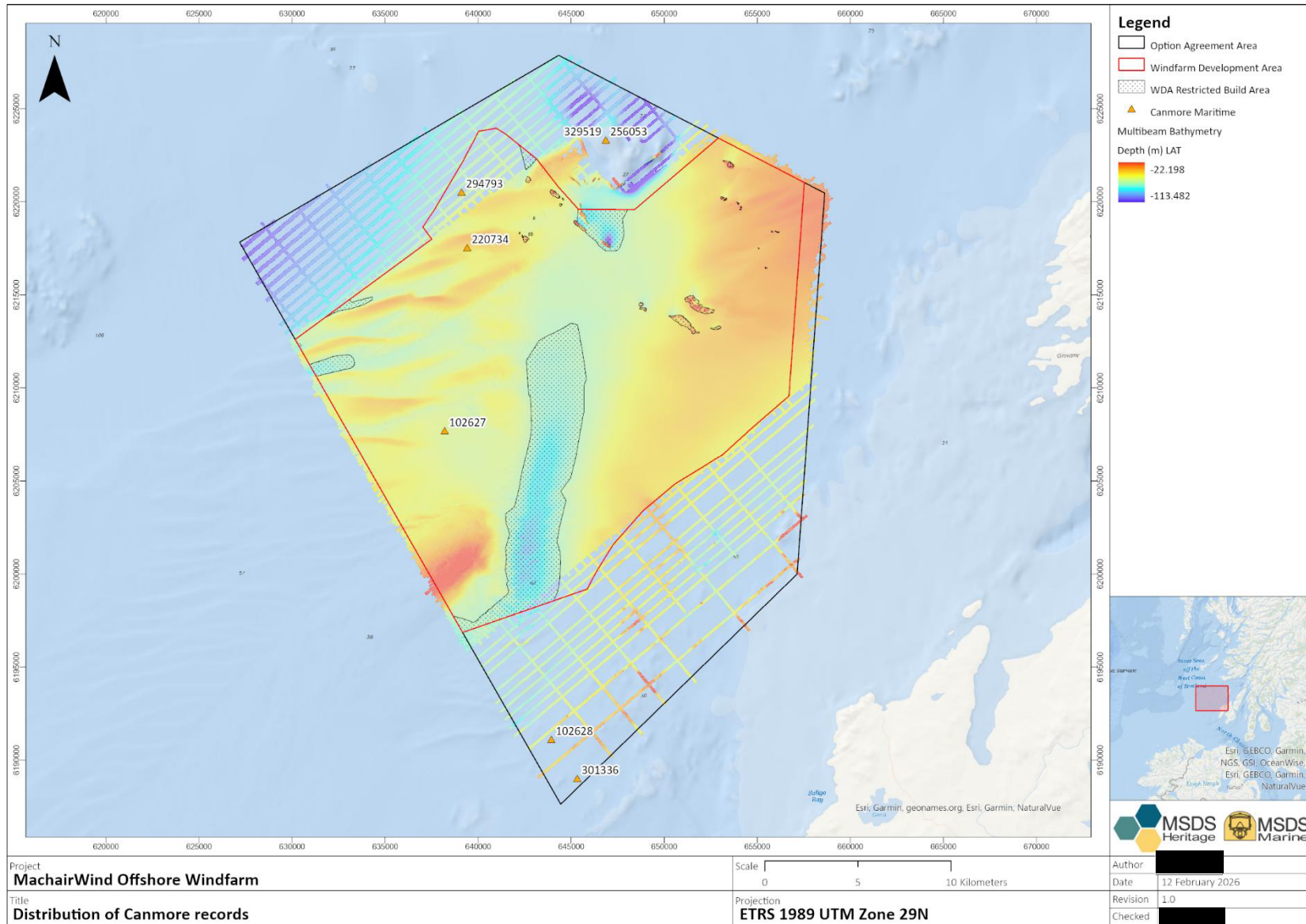


Figure 25: Distribution of Canmore records

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Canmore record 102627

9.0.3 Canmore record 102627 is the record of an unknown wreck. The record originates from UKHO record 3763 and is discussed as such in paragraph 8.1.3.

Canmore record 102628

9.0.4 Canmore record 102628 is the record of an unknown wreck. The record originates from UKHO record 3779 and is discussed as such in paragraph 8.1.4.

Canmore record 220734

9.0.5 Canmore record 220734 lies within, and towards the north of, the WDA, c. 6.4 km south of the northern boundary, the anomaly is outside the WDA Restricted Build Area. The record relates to the documented loss of the *Stanley*; a wooden barque built in 1875 and lost in 1902. The location is arbitrary, and no evidence of the wreck was identified at the given location.

Canmore record 256053

9.0.6 Canmore record 256053 lies within the OAA, c. 3.6 km outside of the WDA. The record relates to the documented loss of the *Caspian*; a brig lost in 1874. The record lies outside the geophysical data coverage so it not possible to determine whether anthropogenic remains are present at the location, however the location is recorded as arbitrary.

Canmore record 294793

9.0.7 Canmore record 294793 lies within, and towards the north of, the WDA, c. 3.6 km south of the northern boundary, the anomaly is outside the WDA Restricted Build Area. The record relates to the documented loss of an unknown vessel lost in 1836 or 1936 (the record lists both dates). The record lies outside the geophysical data coverage so it not possible to determine whether anthropogenic remains are present at the location, however the location is recorded as arbitrary.

Canmore record 301336

9.0.8 Canmore record 301336 lies within the OAA, c. 9.5 km outside of the WDA. The record relates to the documented loss of the *Daneland*; a trawler lost in 1941. The record lies outside the geophysical data coverage so it not possible to determine whether anthropogenic remains are present at the location, however the location is recorded as arbitrary.

Canmore record 256053

9.0.9 Canmore record 256053 lies within the OAA, c. 3.6 km outside of the WDA. The record relates to the documented loss of the aircraft *Handley Page* in 1943. The record lies outside the geophysical data coverage so it not possible to determine whether anthropogenic remains are present at the location, however the location is recorded as arbitrary.

10.0 Mitigation

- 10.0.1 This section provides recommendations for the robust, but proportional, mitigation of impacts to the historic environment for low, medium, and high potential anomalies, and magnetic anomalies, identified within the geophysical dataset. As outlined in **Section 5.6** mitigation for these anomalies will be through the implementation of AEZs, TAEZs and AAPs, as appropriate.
- 10.0.2 The mitigation strategies within this report are based on the available data, which includes full coverage (100%) MBES and (200%) SSS. Magnetometer data were collected at the same line spacing as the SSS and MBES which means there is potential for items of buried material of archaeological interest to be present within the assessment area that is not visible within the current dataset, or for magnetic anomalies to not be represented in their true position.
- 10.0.3 However, the data serve to characterise the potential of the area with respect to the requirement for exclusion zones. Mitigation will be developed through each phase of survey works as detailed within **Section 11.0**.

10.1 Low Potential Anomalies

- 10.1.1 Low potential anomalies, and small magnetic anomalies, have been identified as potentially anthropogenic in origin but unlikely to be of archaeological significance and no exclusion zones are recommended for these anomalies. Should material of potential archaeological significance be identified during the course of pre-construction and construction works they should be reported under an appropriate PAD such as the *Crown Estates Protocol for Archaeological Discoveries: Offshore Renewables Projects*⁹ or a project specific protocol that considers the individual requirements of the MachairWind Offshore Windfarm.

10.2 Archaeological Exclusion Zones (AEZ)

- 10.2.1 Two high potential surface anomalies, and eight medium potential anomalies, have been identified within the geophysical survey data extents, of which two high potential and four medium potential anomalies lie within the WDA, or within a distance where recommended mitigation would be within the WDA. The anomalies have been identified as likely to be of anthropogenic origin and potentially of archaeological significance. The anomalies have been recommended AEZs based on the size of the anomaly, the extents of any debris, the potential significance of the anomaly, the potential impact of the development and the seabed dynamics within the area.
- 10.2.2 Dependent on the form of anomalies, AEZs will either be recommended as a radius from the centre point of the anomaly or as a distance from the extents. Particularly in the case of shipwrecks, which tend to be longer in length than width, the use of a circle provides unequal protection around the extents. This not only impacts the protection afforded but does not represent proportional mitigation.
- 10.2.3 In total six AEZs relating to high and medium potential anomalies have been recommended within the geophysical survey data extents, five of which are within the WDA, and one partially

⁹ The Crown Estate, 2014. *Protocol for Archaeological Discoveries: Offshore Renewables Projects*. Wessex Archaeology on behalf of the Crown Estate.

overlaps with the WDA. To note, the AEZ for high potential MCH25_069 also encompasses UKHO record 79885 (within the WDA) due to a potential relationship.

10.2.4 Anomalies and their recommended exclusion zones are detailed in **Table 19** and the distribution presented in **Figure 26**. Note, where discrepancies exist between the position within different datasets, the position deemed to be most accurate has been used, typically that derived from the MBES data.

Anomaly ID	Description	Potential	ETRS89 Z29N		AEZ (m)
			X	Y	
MCH25_007	Wreck	High	641064.8	6221732.2	100 (extents)
MCH25_026	Potential debris	Medium	638051.4	6200407.0	25 (extents)
MCH25_046	Potential debris	Medium	655396.7	6218510.9	25 (extents)
MCH25_047	Potential debris	Medium	643937.2	6209662.8	25 (extents)
MCH25_066	Potential debris	Medium	635359.4	6209903.2	50 (extents)
MCH25_069	Potential debris	High	638295.2	6220727.1	100 (extents)

Table 19: Archaeological Exclusion Zones within the geophysical survey data extents

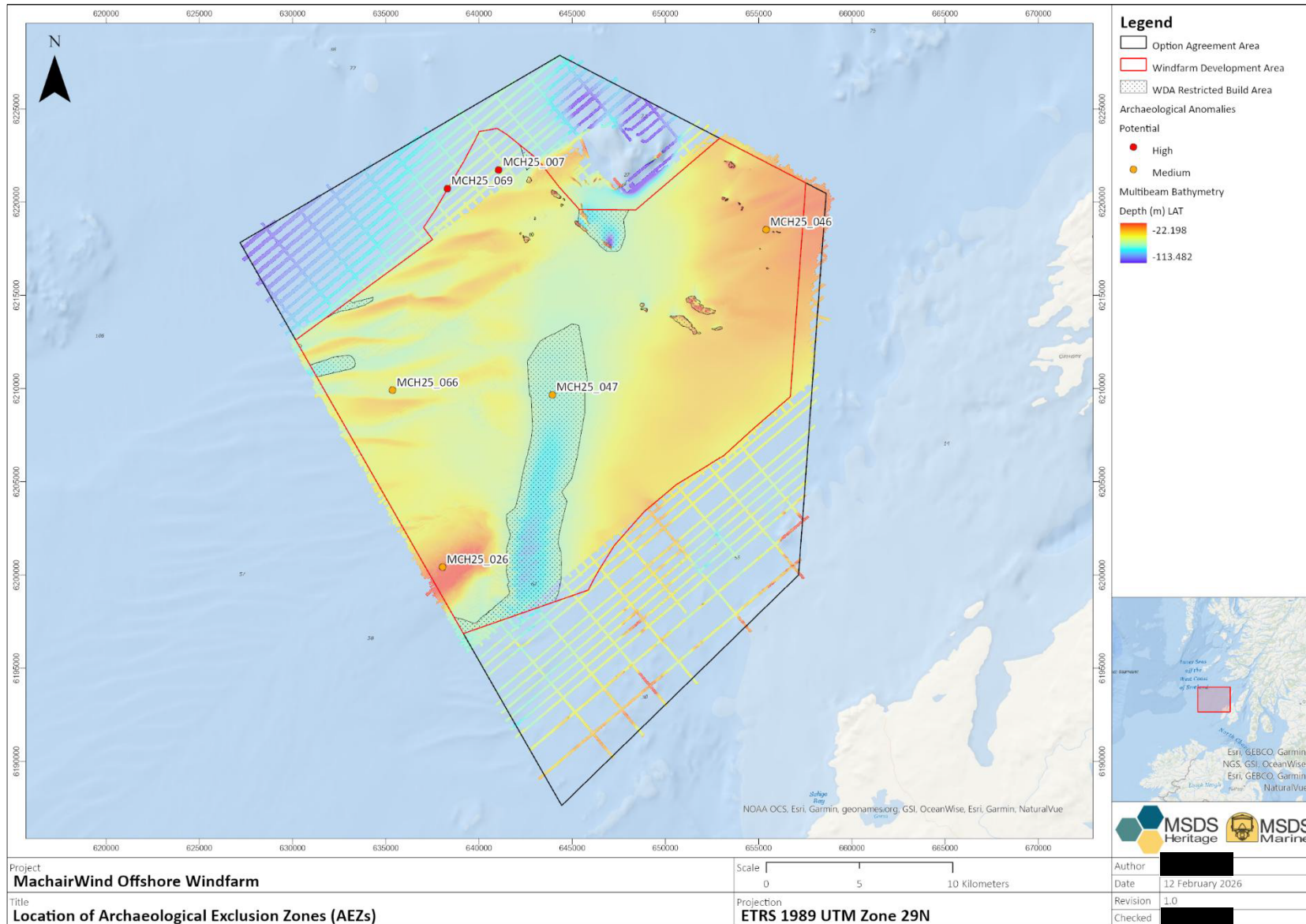


Figure 26: Location of Archaeological Exclusion Zones (AEZs)

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10.3 Temporary Archaeological Exclusion Zones (TAEZ)

- 10.3.1 TAEZs are recommended where an anomaly is not visible in the dataset but is known to exist, where the position cannot be determined with enough accuracy for refined exclusion zones, or where the extents are not fully known. They are often larger than AEZs but are identified as temporary as they are highly likely to be altered following higher resolution or full coverage data assessment, they will remain in place until alterations have been formally agreed with MD-LOT following consultation with HES.
- 10.3.2 No TAEZs are recommended for records originating from the UKHO or Canmore. All record locations have been viewed within the geophysical data, where a feature was visible on the seabed this was assessed for archaeological potential with mitigation recommended as appropriate. Where no feature was visible on the seabed the records were assessed, and in all instances, it was determined unlikely that remains were present, but not visible, on the seabed.
- 10.3.3 No TAEZs are recommended for magnetic anomalies that do not have a strong correlation with a seabed feature due to the 100 m line spacing. However, it should be noted that this is not due to the likely absence of magnetic anomalies that may be of potential archaeological interest, but the vagaries in even approximate positioning, and size of the anomalies due to the wide line spacing. Mitigation should take the form of a commitment to the recommendations for further work in **Section 11.1**, in particular those relating to the collection, and assessment, of magnetometer data.

10.4 Areas of Archaeological Potential (AAP)

- 10.4.1 No formal mitigation in the form of exclusion zones is recommended for AAPs; however, they serve to highlight the potential for material of archaeological interest to identified following the collection of higher resolution, or denser, geophysical survey data. These could originate, for example, from the identification of a high concentration of magnetic anomalies where the positions cannot be determined and with no correlating seabed feature.
- 10.4.2 No AAPs are recommended within the geophysical survey data extents. However, due to the wide spacing of the magnetometer data, there should be a general awareness that following the collection of denser data it is highly likely that additional anomalies of potential archaeological interest will be identified.

10.5 Notes on Exclusion Zones

- 10.5.1 Exclusion zones have been recommended based on the available evidence as interpreted by an experienced and qualified maritime archaeologist, they are to be agreed with MD-LOT following consultation with Historic Environment Scotland (HES). Exclusion zones are implemented to protect, in-situ, potentially archaeologically significant material.
- 10.5.2 Where an exclusion zone has been implemented, no development work impacting the seabed is to take place within the prescribed area. Should an exclusion zone impact the development program it is recommended that a program of ground truthing be undertaken to establish the identity of an anomaly in order that the potential archaeological significance can be assessed by a qualified and experienced archaeologist. Following identification and assessment, the exclusion zone can be re-assessed to ensure mitigation is appropriate to the archaeological

significance of the anomaly.

10.6 Protocol for Archaeological Discoveries (PAD)

- 10.6.1 An appropriate PAD such as the *Crown Estates Protocol for Archaeological Discoveries: Offshore Renewables Projects*¹⁰ should also be applied across the scheme. Such protocols provide a means of identifying previously unidentified archaeological remains and are an important part of the mitigation process.

¹⁰ The Crown Estate, 2014. *Protocol for Archaeological Discoveries: Offshore Renewables Projects*. Wessex Archaeology on behalf of the Crown Estate.

11.0 Recommendations for Future Work

11.1 Archaeological Assessment of Geophysical Data

- 11.1.1 The archaeological interpretation of the geophysical data collected at the pre-application stage, to which this assessment pertains, fits within a wider framework of planned geophysical survey for the WDA. The survey specification was designed for the purposes of consenting and FEED to determine the most appropriate area for development. Future surveys are likely to be focused on those areas identified for construction works and will likely combine an increase in resolution, and the addition of magnetometer data with tighter line spacing (as determined by the pUXO risk). With the data resolution set to increase, the confidence in interpretation and appropriateness of mitigation strategies will also increase.
- 11.1.2 The specification of future surveys should be determined with input from an archaeologist and should align with those presented for an ‘investigation’ survey in *Marine Geophysics: Data Acquisition Processing and Interpretation Guidance Notes (2nd Edition)*¹¹: All geophysical data collected as part of the development should be assessed for archaeological potential where relevant to the development and its impacts on the seabed. It is recommended that the archaeologist have a demonstrable background in both the collection and processing of geophysical data as well as the archaeological review of data. The data collection, and interpretation, methodology should follow that set out within the Written Scheme of Investigation (WSI).

11.2 PAD

- 11.2.1 A suitable PAD is a key element of the mitigation procedures, particularly for anomalies identified as low archaeological potential, including small magnetic anomalies. A suitable protocol should also be implemented during any works that may visually inspect the seabed or recover material to deck.
- 11.2.2 The protocol could take the form of the Crown Estates *Protocol for Archaeological Discoveries: Offshore Renewables Projects*¹² or a project specific protocol that considers the individual requirements of the WDA infrastructure. The protocol will be agreed with MD-LOT, following consultation with HES prior to any impact on the seabed.

11.3 Ground Truthing

- 11.3.1 Should archaeological exclusion zones impact on the proposed development works it is recommended that a program of ground truthing is undertaken to establish the identity of the anomalies so that further archaeological assessment can be undertaken, and interpretations revised as appropriate.

¹¹ Historic England, 2025. *Marine Geophysics: Data Acquisition Processing and Interpretation Guidance Notes (2nd Edition)*. Historic England, Swindon.

¹² The Crown Estate, 2014. *Protocol for Archaeological Discoveries: Offshore Renewables Projects*. Wessex Archaeology on behalf of the Crown Estate.

12.0 References

Historic England (2025). *Marine Geophysics: Data Acquisition Processing and Interpretation Guidance Notes* (2nd Edition). Historic England, Swindon.

Holt, P (2019). *Marine Magnetometer Processing*. 3H Consulting Ltd

MSDS Marine (2026). *MachairWind Offshore Windfarm. Archaeological Assessment of Geophysical and Hydrographic Data. Palaeolandscape Assessment*. Ref: MCW-DWF-ENV-REP-RHS-000179

The Crown Estate (2014). *Protocol for Archaeological Discoveries: Offshore Renewables Projects*. Wessex Archaeology on behalf of the Crown Estate.

12.1 Online sources

<https://datahub.admiralty.co.uk/portal/apps/sites/#/marine-data-portal/datasets/4dbf2ace22bf4f9785fb445d0593bc2c/about> [Accessed 20/10/2025]

<https://portal.historicenvironment.scot/apex/f?p=PORTAL:downloads:::::DATASET:NHRE> [Accessed 20/10/2025]

<https://www.wrecksite.eu/ukhoAbbrev.aspx> [Accessed 20/10/2025]

13.0 Annex A – Anomalies of Archaeological Potential

Name	Potential	Description	Mag (nT)	Length (m)	Width (m)	Height (m)	AEZ (m)	AEZ Type	X	Y
MCH25_001	Medium	Potential debris	<Null>	13.7	11.1	0.2	<Null>	<Null>	639247.8	6224873.2
MCH25_002	Medium	Potential debris	<Null>	21.8	8.3	1.1	<Null>	<Null>	639176.0	6224894.5
MCH25_003	Medium	Potential debris	<Null>	10.1	7.9	0.1	<Null>	<Null>	639211.2	6224930.6
MCH25_005	Low	Potential debris	<Null>	1.9	2.1	0.1	<Null>	<Null>	635881.8	6222023.6
MCH25_006	Low	Potential debris	<Null>	2.5	2.3	0.0	<Null>	<Null>	641252.9	6222550.7
MCH25_007	High	Wreck	<Null>	120.4	31.1	1.3	100	Extents	641064.8	6221732.2
MCH25_008	Low	Fishing gear	<Null>	41.4	29.0	0.0	<Null>	<Null>	631347.4	6212486.2
MCH25_010	Low	Chain cable or rope	<Null>	35.7	0.5	0.1	<Null>	<Null>	645986.6	6224767.1
MCH25_011	Low	Fishing gear	<Null>	205.7	0.1	0.1	<Null>	<Null>	642975.8	6220851.6
MCH25_012	Low	Potential debris	<Null>	4.4	3.0	0.1	<Null>	<Null>	632193.3	6211141.6
MCH25_013	Low	Seabed disturbance	<Null>	7.9	8.2	0.1	<Null>	<Null>	637919.3	6223087.7
MCH25_014	Low	Potential debris	<Null>	3.2	0.9	0.1	<Null>	<Null>	650196.0	6223904.0
MCH25_015	Low	Potential debris	<Null>	2.1	0.5	0.2	<Null>	<Null>	650223.5	6223921.8
MCH25_017	Low	Potential debris	<Null>	5.7	0.4	0.0	<Null>	<Null>	651363.7	6223305.4
MCH25_018	Low	Fishing gear	<Null>	71.2	3.6	0.3	<Null>	<Null>	652150.0	6223408.3
MCH25_019	Low	Fishing gear	<Null>	9.5	1.9	1.2	<Null>	<Null>	637278.5	6210810.3

Name	Potential	Description	Mag (nT)	Length (m)	Width (m)	Height (m)	AEZ (m)	AEZ Type	X	Y
MCH25_020	Low	Potential debris	<Null>	4.4	1.7	0.3	<Null>	<Null>	650891.5	6221600.1
MCH25_021	Low	Fishing gear	<Null>	167.1	0.5	0.0	<Null>	<Null>	641126.0	6212711.3
MCH25_022	Low	Seabed disturbance	<Null>	4.8	2.7	0.0	<Null>	<Null>	643544.9	6204235.3
MCH25_023	Low	Likely geological	<Null>	5.5	1.0	0.3	<Null>	<Null>	640072.3	6198795.6
MCH25_024	Low	Potential debris	<Null>	2.5	0.4	0.1	<Null>	<Null>	647409.4	6203723.0
MCH25_025	Low	Fishing gear	<Null>	208.5	23.9	0.2	<Null>	<Null>	638369.3	6203922.0
MCH25_026	Medium	Potential debris	<Null>	8.1	2.8	1.5	25	Extents	638051.4	6200407.0
MCH25_027	Low	Potential debris	<Null>	0.9	1.0	0.2	<Null>	<Null>	643886.9	6205293.6
MCH25_028	Low	Potential debris	<Null>	0.6	1.1	0.2	<Null>	<Null>	643860.9	6205258.2
MCH25_029	Low	Potential debris	<Null>	3.0	0.8	0.1	<Null>	<Null>	645439.0	6204681.8
MCH25_030	Low	Fishing gear	<Null>	305.0	0.5	0.2	<Null>	<Null>	645646.4	6204531.3
MCH25_031	Low	Fishing gear	<Null>	112.8	0.3	0.1	<Null>	<Null>	642171.6	6199178.9
MCH25_032	Medium	Potential debris	<Null>	32.9	14.8	0.2	<Null>	<Null>	644732.7	6194415.6
MCH25_033	Low	Likely geological	<Null>	54.0	18.5	0.6	<Null>	<Null>	647240.4	6190207.5
MCH25_035	Low	Potential debris	<Null>	2.4	2.3	0.5	<Null>	<Null>	642800.4	6209006.5
MCH25_036	Low	Potential debris	<Null>	8.9	0.8	0.1	<Null>	<Null>	639854.8	6214570.2
MCH25_037	Low	Potential debris	<Null>	4.2	0.5	0.1	<Null>	<Null>	653538.5	6222193.7
MCH25_038	Low	Potential debris	<Null>	6.6	1.4	0.1	<Null>	<Null>	650096.1	6218344.0

Name	Potential	Description	Mag (nT)	Length (m)	Width (m)	Height (m)	AEZ (m)	AEZ Type	X	Y
MCH25_039	Low	Fishing gear	<Null>	193.3	1.6	0.2	<Null>	<Null>	653717.4	6223002.8
MCH25_040	Low	Seabed disturbance	<Null>	24.7	8.1	0.2	<Null>	<Null>	635151.9	6211974.6
MCH25_041	Low	Potential debris	<Null>	3.4	1.0	0.2	<Null>	<Null>	633500.6	6211295.7
MCH25_042	Low	Potential debris	<Null>	6.9	2.2	0.3	<Null>	<Null>	637049.3	6215056.7
MCH25_043	Low	Potential debris	<Null>	4.2	1.0	0.2	<Null>	<Null>	632982.2	6213030.9
MCH25_044	Low	Potential debris	<Null>	5.6	0.7	0.1	<Null>	<Null>	638370.0	6218346.2
MCH25_045	Low	Fishing gear	<Null>	45.6	5.1	0.3	<Null>	<Null>	638876.8	6218946.1
MCH25_046	Medium	Potential debris	26.3	44.2	9.4	0.3	25	Extents	655396.7	6218510.9
MCH25_047	Medium	Potential debris	<Null>	7.6	7.6	0.1	25	Extents	643937.2	6209662.8
MCH25_048	Low	Potential debris	<Null>	7.9	0.9	0.1	<Null>	<Null>	643573.7	6210548.7
MCH25_049	Low	Likely geological	<Null>	10.1	2.0	0.1	<Null>	<Null>	644291.7	6210883.2
MCH25_050	Low	Likely geological	<Null>	3.3	2.0	0.2	<Null>	<Null>	640622.5	6208827.6
MCH25_051	Low	Seabed disturbance	12.3	8.9	7.1	0.8	<Null>	<Null>	644623.6	6212312.8
MCH25_052	Low	Potential debris	6.0	2.0	1.0	0.3	<Null>	<Null>	650848.0	6217553.3
MCH25_053	Low	Fishing gear	<Null>	122.1	0.7	0.2	<Null>	<Null>	653546.1	6216396.0
MCH25_054	Low	Potential debris	<Null>	5.8	3.3	0.1	<Null>	<Null>	658483.1	6219272.5
MCH25_055	Low	Seabed disturbance	<Null>	9.0	2.0	0.1	<Null>	<Null>	647287.3	6208846.8
MCH25_056	Low	Fishing gear	<Null>	344.2	20.3	0.2	<Null>	<Null>	648187.2	6208505.9

Name	Potential	Description	Mag (nT)	Length (m)	Width (m)	Height (m)	AEZ (m)	AEZ Type	X	Y
MCH25_057	Low	Potential debris	<Null>	6.7	1.6	0.6	<Null>	<Null>	638059.6	6199520.4
MCH25_058	Low	Potential debris	<Null>	5.3	2.7	0.2	<Null>	<Null>	657618.6	6214515.0
MCH25_059	Low	Likely geological	<Null>	4.1	3.2	0.1	<Null>	<Null>	653245.7	6211208.7
MCH25_060	Low	Likely geological	<Null>	6.3	3.7	0.1	<Null>	<Null>	645453.5	6203758.2
MCH25_061	Low	Fishing gear	<Null>	462.7	0.8	0.2	<Null>	<Null>	650306.0	6206867.2
MCH25_062	Low	Potential debris	<Null>	0.9	1.5	0.1	<Null>	<Null>	638891.6	6197217.9
MCH25_063	Low	Likely geological	<Null>	17.6	3.9	0.3	<Null>	<Null>	643788.1	6201269.5
MCH25_064	Low	Fishing gear	<Null>	238.1	0.1	0.2	<Null>	<Null>	640337.9	6218436.2
MCH25_065	Low	Likely geological	<Null>	2.0	0.9	0.4	<Null>	<Null>	646513.9	6205720.5
MCH25_066	Medium	Potential debris	<Null>	11.7	3.7	0.3	50	Extents	635359.4	6209903.2
MCH25_067	Low	Potential debris	<Null>	3.8	2.1	0.7	<Null>	<Null>	638770.6	6199350.9
MCH25_068	Low	Likely geological	<Null>	32.4	2.6	0.3	<Null>	<Null>	655112.2	6221273.8
MCH25_069	High	Potential debris	<Null>	15.5	11.0	0.2	100	Extents	638295.2	6220727.1